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ABSTRACT

Research is lacking on the social and environmental impacts and policy implications of urban transportation. The major goals of this paper are to focus on these problems by (1) examining choice and social travel linkages in the city; (2) examining the spread of transportation to the deprived population; (3) reviewing research aimed at reducing the negative impacts of transportation systems on the social and physical environment; and (4) contributing to the environmental and social quality through transportation planning policy implications. The social dimensions of travel in urban areas are analyzed in relation to hypotheses regarding social interaction fields. The current status of transportation for disadvantaged groups--the poor, the youth, the handicapped, and the elderly--is described and alternatives are proposed. The impact and implications of actual transit routes and systems in selected American cities are explored. Recommendations are made which would enable transit systems to fulfill the transportation needs of all groups, while maintaining positive land use and environmental policies. (Author/GC)

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SOCIAL ASPECTS OF INTERACTION AND TRANSPORTATION

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FOREWORD

In 1968, the Commission on College Geography of the Association of American Geographers published its first Resource Paper, *Theories of Urban Location*, by Brian J. L. Berry. In 1974, coinciding with the termination of NSF funding for the Commission, Resource Paper number 28 appeared, *The Underdevelopment and Modernization of the Third World*, by Anthony R. deSouza and Philip W. Porter. Of the many CCG activities, the Resource Papers Series became an effective means for permitting both teachers and students to keep abreast of developments in the field.

Because of the popularity and usefulness of the Resource Papers, the AAG applied for and received a modest grant from NSF to continue to produce Resource Papers and to put the series on a self-supporting basis. The present Resource Papers Panel subscribes to the original purposes of the Series, which are quoted below:

> The Resource Papers have been developed as expository documents for the use of both the student and the instructor. They are experimental in that they are designed to supplement existing texts and to fill a gap between significant research in American geography and readily accessible materials. The papers are concerned with important concepts or topics in modern geography and focus on one of three general themes: geographic theory; policy implications; or contemporary social relevance. They are designed to implement a variety of undergraduate college geography courses at the introductory and advanced level.

In an effort to increase the utility of these papers, the Panel has attempted to be particularly sensitive to the currency of materials for undergraduate geography courses and to the writing style of these papers.

The Resource Papers are developed, printed, and distributed under the auspices of the Association of American Geographers, with partial funding from a National Science Foundation grant. The ideas presented in these papers do not imply endorsement by the AAG.

Many individuals have assisted in producing these Resource Papers, and we wish to acknowledge those who assisted the Panel in reviewing the authors' prospectuses, in reading and commenting on the various drafts, and in making helpful suggestions. The Panel also acknowledges the perceptive suggestions and editorial assistance of Jane F. Castner of the AAG Central Office.

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PREFACE

This Resource Paper has been written to fill a gap that currently exists in text material for urban and transportation geography courses. It can be used as supplementary reading material for such courses and it is aimed primarily at the undergraduate geography student and the teacher of introductory courses.

The Association of American Geographers has published other Resource Papers relating to the general themes covered here. These are: *Social Processes in the City* (No. 6), *Residential Mobility in the City* (No. 13), *Metropolitan Neighborhoods: Participation and Conflict over Change* (No. 16), *Society, the City and the Space-Economy of Urbanism* (No. 18), and *Participation, Decentralization, and Advocacy Planning* (No. 25). In addition, *Land Use Control: Interface of Law and Geography* (No. 75-1) and *The Outer City: Geographical Consequences of the Urbanization of the Suburbs* (No. 75-2) might also be used effectively in conjunction with this paper.

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I. INTRODUCTION

The 1960's were characterized by economic and quantitative studies of transportation flow and network analysis, but by the early 1970's these studies began to be conditioned by changes occurring in society. These changes were chronicled in more humanistic approaches to transportation. In identifying this change, Bunge (1973) saw the new paradigm of geography as centered on contemporary human conditions. He viewed the old transportation geography as dealing with machine spaces and the new transportation geography as dealing with human spaces. Appleyard (1971) perhaps saw the need for such a change even earlier when he outlined his view of the goals of social transportation development. These included 1) increasing transportation service to the socially deprived groups within the city, 2) mitigating the negative transportation impacts on the human and natural landscapes, and 3) enhancing environmental quality through comprehensive transportation planning and policy implications. In 1973 a special issue of *Economic Geography* devoted to social aspects of transportation added a fourth major area of social interaction as an approach to community enhancement. This special issue included the topic of social interaction as well as transportation of the disadvantaged in rural areas, urban transportation policy considerations, and the impact on society of the location of transportation facilities. It helped mark the beginning of the examination by geographers of such social approaches to transportation.

Some progress has been made on the topic of transportation problems of disadvantaged groups, although most of the literature stems from social and health science planning. Muller (1976b) has given a short review of such material in *Progress in Geography*. A substantial number of studies of social interaction and interpersonal attraction have been produced by sociologists and social psychologists, but most of these lack the spatial dimensions or public policy implications of such interaction (Stutz, 1971). Such studies are just now beginning to emerge in geography. There has been relatively little geographical research on the environmental impacts and policy implications of transportation. Engineering groups and highway planners at university transportation centers have produced most of this work. There is little question then that insufficient emphasis has been placed on social elements of the study of transportation. Consequently, a lack of awareness of policy implications in transportation research has been commonplace. This Resource Paper hopes to offer some initial contributions to the understanding of societal and policy issues in the field of transportation study.

The major goals of the paper are to focus on the above-outlined problems by 1) examining choice and social travel linkages in the city in an attempt to increase the accessibility of community services for the whole population, 2) examining the spread of transportation to the deprived populations, 3) studying research aimed at reducing the negative impacts of transportation systems on the social and physical environment, and 4) contributing to environmental and social quality through transportation planning policy implications.

Social travel linkages, the transportation problems of the disadvantaged, and social impacts of transportation have been the three aspects of social transportation that have received the most attention thus far. Until now, these topics have been studied independently of each other. Community planning is a unifying concept of these three themes, because it is the community and its residents that bear the burden of most of the negative social outputs of transportation systems. Incipient social travel patterns from communities provide inter-residential social ties that are determined by existing transportation route locations and linkages. Finally, the shortcoming of the regional concept of community as a self-sufficient service territory has caused many of the transportation problems of the disadvantaged because of the inordinant distances they must overcome to meet their basic subsistence needs.

To demonstrate the interrelated nature of these three topics, one might examine pedestrianism. The volume of walking in a community, of major importance to the disadvantaged, is an indicator of social interaction and community cohesion. Youth or elderly who are unable to use public transportation or private automobiles without aid, must rely on walking for many trip purposes. The physical arrangement of the community encourages or discourages pedestrianism. Traffic is the greatest barrier to all those segments of the population dependent upon walking as their primary mode of transportation. Traffic produces impacts on the community not only with imposed barriers but also with noise and air pollution. The volume and velocity of traffic are related to the relative area of the community pedestrians may cover and become familiar with. Ease of access to community facilities, whether for medical needs, education, shopping, or recreation, is of primary importance to the disadvantaged. One measure of social neighboring is the willingness of people to help each other. Obviously the disadvantaged need the assistance and cooperation of neighbors more so than any other group in society. Consequently they exhibit the greatest willingness to participate in this manifestation of community cohesion.

Thus, the impacts of transportation, its routes which help to create community boundaries, the resultant social interaction that they cause, and the forced need for mobility most sensitively felt by the elderly and handicapped, are all related problems. This Resource Paper will attempt to weave these topics together and to discuss the policy implications relevant to planning analysis at various scales. Chapter One will introduce the interdependencies of these problems.

Chapter Two involves the social dimensions of travel. Policy considerations deal inevitably with public and social welfare. This portion of the paper examines the social theme vis-a-vis the structure of urban areas by analyzing urban travel undertaken for social purposes and reviews several hypotheses regarding social interaction fields. Analysis of urban travel is not limited to social travel: interaction areas for all trips within cities and the role that urban spatial structure plays in their formation are identified. Strong internal interaction is a necessary feature of strong community consciousness and the latter is important for the prevention of community environmental deterioration. Policy implications are that strong community consciousness and interaction are unlikely to develop or sustain themselves in subareas with diffused social interaction and service-node dispersion.

Chapter Three covers transportation for the disadvantaged groups—the poor, the youth, the handicapped, and the elderly. Many events and trends have contributed to today's increased awareness of and concern for the problems of the disadvantaged. Improving health and medical technology increases the natural longevity of our elderly and handicapped population. It also enables them to survive and to be rehabilitated. Minority groups, especially blacks, have recently become more vocal about their transportation needs. Other factors responsible for this increased awareness are 1) a greater public knowledge of architectural barriers to the mobility of disadvantaged persons, 2) a spread of the viewpoint that these problems need and deserve public attention and action as opposed to strictly individual or private approaches, 3) greater organization and public visibility among these groups, especially the blacks and poor, working through political means for their own betterment, and 4) more and better legislation providing support for them, specifically such Urban Mass Transportation Administration (UMTA) requirements to consider these groups in transportation planning and implementation. Observations suggest that all or most of these trends will continue for some time in the future. Overall study objectives for Chapter Three will be as follows: 1) to articulate the characteristics of transit use and to delineate the problems associated with specific constraining conditions, 2) to determine the number of transportation disadvantaged poor, youth, handicapped, and elderly, and 3) to determine the responsiveness of transit systems to the travel needs of these groups. The chapter includes a brief description of the status, existing services, and transit needs and demands of the disadvantaged. Alternative solutions to problems brought out are also discussed. These include the upgrading of existing or planned systems, dial-a-ride feasibility, transit stamps, coupon taxi service, and a ubiquitous fixed route service. Various impacts will be analyzed and recommendations made about further studies and reports as well as suggestions to aid local planners.

Chapter Four emphasizes the goals, implementation, and impacts of the construction of actual transit routes and systems. An analysis of a regional highway network demonstrates the geographically variable impact of transportation policy. Various intraurban studies reviewed show that locational impacts vary with distance and with socioeconomic and demographic factors, generating questions of equity considerations. In this chapter, a distinction is made between user and nonuser costs and benefits. The former refer to the advantages realized by those who actually use the facilities. Nonuser benefits go to the community or to society in general as well as to specific economic activities. Costs of neighborhood disruption, family relocation, as well as temporary problems of construction, noise, and inconvenience are covered. Everyone is aware of the concern of area residents and organized civic groups for easing the burden of social and environmental impacts of major transportation construction. The requirement for public hearings to study alternative alignment possibilities is used increasingly for providing answers to these questions. At the same time, demands for transportation necessitate accelerating decisions involved in the complex issues of route location. Analysis of potential environmental impacts or hazards associated with the construction of any transportation facility depends largely on loosely documented and subjective—often emotional—judgments by area residents and even civic and private groups. This may be a reaction to the fact that typically, resulting transportation routes have assumed straight-line corridors that ignore the living fabric of the land over which they pass. But the more intensive land use and activity requirements of the future demand a more objective and comparative basis for selection among alternatives. Optimization of environmental factors for future human use must be based on an objective value analysis of these factors. These environmental and aesthetic factors should be weighted objectively, calibrated, and then added to the traditional costs and benefits in a monetary fashion. Research on this topic is just now surfacing.

Chapter Five concludes the discussion and makes recommendations that would enable a transit system to remove barriers associated with physical, institutional, economic, informational, and service operational functions that will better fulfill the transportation needs of all groups. Chapter Five also suggests strategies for improved social interaction and mitigation of transportation impacts through land use control and community planning.

II. SOCIAL INTERACTION

The city has been described primarily as an economic entity to exchange goods and services. Political origins of the city have been attributed to the need for public administration, defense, and a vehicle for providing law and order. The city is also the principal conduit for person and information flow, and for social and cultural exchange. Access to social opportunity and cultural growth has also attracted people to the city. This almost overwhelming diversity of opportunities and their resulting social patterns sets the city apart from rural and small town settlements. In contrast to small town or single neighborhood residents, each person in the urban area can select only a small proportion of the total social contacts among those that are actually available. It is not that urban residents have fewer friends than small town residents; they are simply beset by many more strangers. Interaction with most city acquaintances is not directly related to distance so much as it develops through a set of social networks or communication channels resulting from the city-dweller's number and diversity of roles (Figure 1). The size of the city and the division of labor suggest that the city dweller will have distinctly different networks in the neighborhood in business, in formal organizations, e.g. church clubs, and in kinship.

The way people initiate social interaction frequently indentifies the type of network that will evolve. Friendship may develop from neighborhood interaction at the local level. Among the strong situational influences for such interaction is sharing a common turf or territory and defending it against the incursions of high-rise apartment buildings, or new or enlarged streets or highways that bring increased congestion. On the other hand, a mutual acquaintanceship process can develop if neighborhoods seek new or expanded services such as creating an assessment district to develop a local park. Another process that fosters neighborhood level social interaction is the similarity of the residents themselves.

The urban area is a patchwork of neighborhoods and of their larger, more formalized counterparts, communities. In the large urban area, the residents of each patch closely resemble each other in a variety of ways because of the available housing stock. The similarity of housing stock may result from lot size and zoning restrictions, but more likely may derive from the age of the structures and the social class of the intended market at the time of construction. Similarity of socioeconomic characteristics and in life cycle stage of residents provides for an adult relationship developed through the children as they join in play. This leads to more formalized types of interaction based on recreation and mutual cooperation and assistance. Mutual assistance provided through babysitting, car pooling, or borrowing food or tools is most easily brought about in a neighborhood where there is a high degree of resident similarity. But the greatest factor for neighborhood friendship formation is the chance of personal contact as a result of proximity and of compliance with standard rules of interpersonal behavior, manifest in various forms of interaction. Because of residential turnover and out-migrations, visiting former neighbors may require a long-distance trip to a location which is totally foreign to the trip maker. In this way, interaction created at the local level by propinquity is now a part of an individual's unique communications network which may stretch across the entire city.

Perhaps the largest and most common category of social interaction is brought about through work acquaintanceships and membership in formal organizations because of the proximity and similarity of roles played by fellow workers and members. With work relationships, trips are likely to be longer than in the neighborhood, because today there is only a small correlation between an individual's work location and residential location.

Church membership is the single largest category of formal associations in the United States (Moberg, 1962). Originally church membership was locally based, and still is in outlying suburbs, but today church membership and the resulting social contacts are diffused over a large part of the city (Sopher, 1967). Most

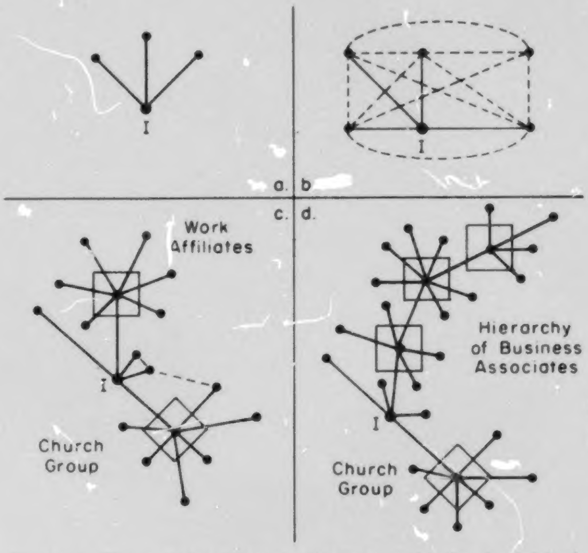

Figure 1. The social communication network of an individual: a. I is connected to three friends only; b. I is connected to five friends and each of their friendships are shown; c. work and church ties; d. a hierarchical communications network (Wheeler, 1974: 29).

TABLE 1. RELATIONSHIP OF MOST FREQUENT CONTACT BY HOUSING CHANGE

Housing Change (moved from)	Relationship % of Total Contacts for Each Housing Change: Family or Relative	Neighbor	Friend	N
House to House	37.0	34.4	28.6	189
House to Apartment	39.9	20.0	40.0	65
Low-Rise to House	32.4	26.5	41.0	83
Low-Rise to Apartment	27.7	22.9	49.4	83
Apartment to House	42.7	23.0	34.4	61
Apartment to Apartment	32.1	23.4	44.5	218

N is the sample size.
Source: Michelson, 1974: 165.

churches promote assistance among churchgoers. Various church denominations also stratify members by socioeconomic level. The proximity among churchgoers reduces the amount of perceived dissimilarity than would otherwise be the case on the basis of person characteristics alone because of functional proximity and ideological similarity. The church, then creates an extremely popular source of social contacts. Similar forces creating friendship relations are fostered by membership in clubs and organizations as well.

Kinship is a third type of social relationship. Originally the urban sociologists viewed the city as one of the principal forces which tended to reduce family ties. Reduced ties have occurred among the extended family (grandparents, parents, children, etc.) in the city because of clustered living arrangements. Population densities and reduced lot sizes, along with certain social services available from local agencies, good mobility, and telephone ubiquity make the extended family living arrangement no longer popular with urbanites. Kinship, however, has remained an important facet of urban social interaction, probably because it is the prime example of group homogeneity and the provision of assistance in the time of need (Litwak, 1960a; Adams, 1968; Bott, 1971). But even though kinship may be spread physically over a wide area of the city, several studies have reported that at least thirty percent of the social visiting in the city involves kinship relations (Axelrod, 1965; Wellman *et al.*, 1973). Michelson (1974) identified the types of social ties for families in Toronto about to make a residential change, according to the nature of the move itself (Table 1). The three components of social interaction were family, neighbor, and friend, with family having a surprisingly large proportion of the total. Prior to Michelson, Stutz (1973b) was able to identify these three components of urban social interaction by grouping social contacts spatially (one component is shown in Figure 2). From interviews in four San Diego communities, he was able to report nine different types of social ties (Table 2). Each of three groups—friends, neighbors, and relatives—had a unique spatial pattern (Figure 3).[1]

Thus, the spatial and social network of the urbanite is spatially distinct for each type of social tie. Urban dwellers must deal with coordinating and maintaining these many networks over time and space. The situational influences, work roles, prejudices, and biases change more quickly for urban dwellers than they do for rural dwellers, and they must adjust their social relationships more quickly to meet these conditions. The neighborhood friendship is probably the most quickly altered, because residential turnover is so great in many cities, especially in high density areas of rental housing.[2]

Although some former neighbors remain a source of friendship and social interaction, as time and distance costs increase interaction soon becomes prohibitive. Changes in family structure and composition tend to alter the social ties of the family. As the family life cycle progresses, residential space needs change, often requiring a move to a new neighborhood. Some families are not able to move because of economic constraints, but their social ties will be altered as educational, recreational, and other needs change. A change in one's job, in club membership, and formal organizations has a major effect, as well, on an individual's social network. Shulman (1972), found that approximately one-half of the persons interviewed had changed the majority of their most intimate friends within the period of only one year. Craven and Wellman (1974) identify the milieu in which social ties are altered:

> Over time, and in the face of changing personal circumstances, active transactions within the network fluctuate among different members. The members called on for assistance in job seeking may not be those who are called on for financial help or for emotional support in times of crises. Certain members may very well be called on in a number of capacities, and some are likely to occupy positions of centrality in the urbanite's inter-

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[1] Stutz gathered the research data through a home interview study conducted in four residential areas of San Diego in the summer of 1971. He selected each house randomly, and conducted approximately fifty interviews in each of the four areas. The questionnaire asked the respondent to give the location and frequency of his or her three most important social contacts. Another question asked the respondent to give the way in which the social contact was formed. Stutz was able to discern nine categories of social contacts from the responses to his question—the neighborhood, children, co-workers, church, club, former neighbor, former school friend, and relative. He constructed his questionnaire in order to identify characteristics of the respondent, such as occupation, age, and length of residence, and designed a 42 × 9 data matrix in which the nine categories of social contacts were considered as variables. The observational units were residential distance units in increments of one-half mile, beginning with a distance of next door and extending beyond twenty miles. The observations arrayed the frequency of every type of social contact made by the residents of the four areas at each location away from home.

[2] In Los Angeles, for example, with a component of military in the Long Beach area, itinerant farm workers in the northern areas, geographically mobile aerospace workers scattered throughout, and a strong student and Mexican-American component, the average length of time that a household is at one address is only three years. Five years residential tenure is considered to be a national average in the United States.

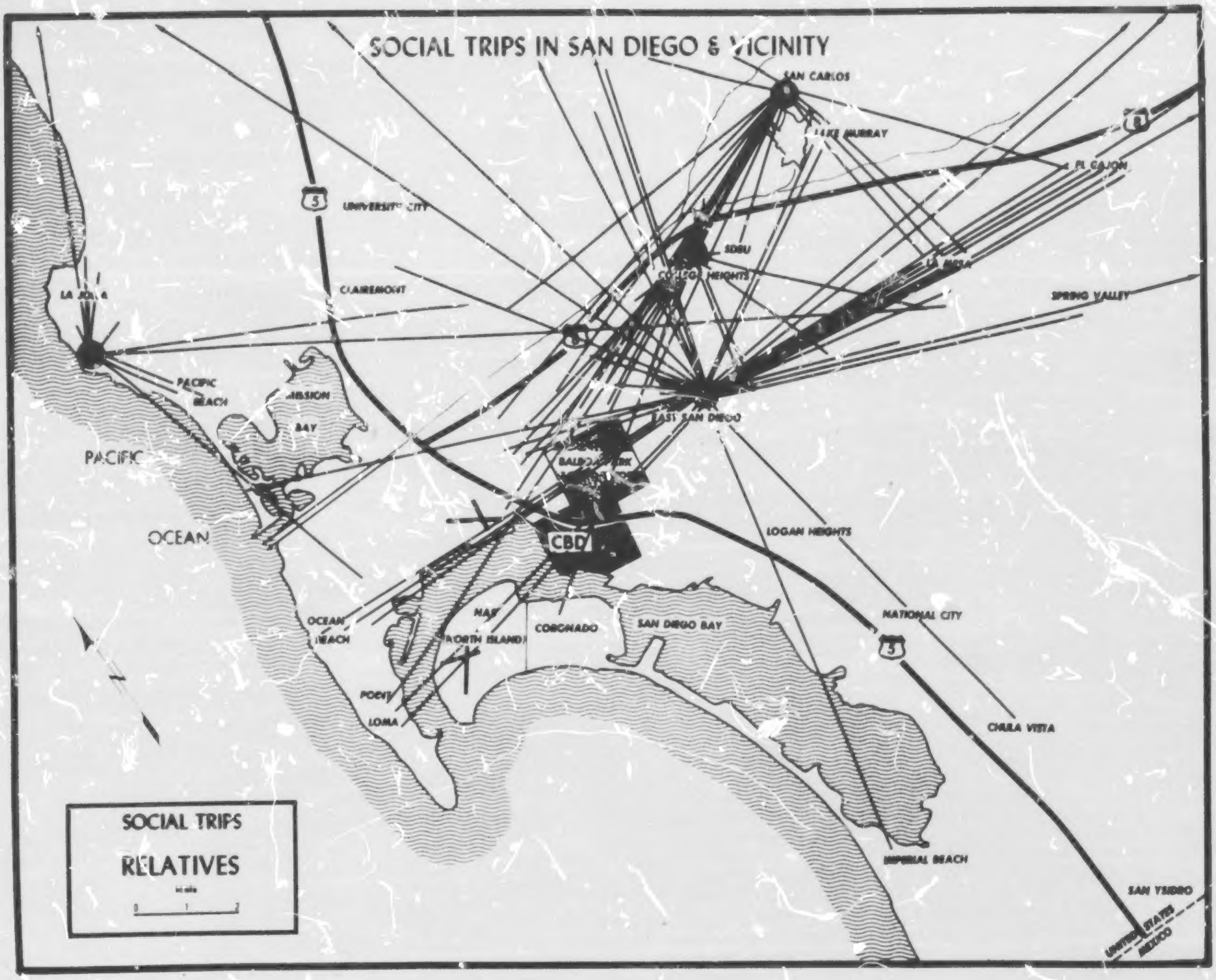
SOCIAL TRIPS IN SAN DIEGO & VICINITY
SAN CARLOS
LAKE MURRAY
8
EL CAJON
5
UNIVERSITY CITY
SDSU
LA MESA
COLLEGE HEIGHTS
SPRING VALLEY
LA JOLLA
CLAIREMONT
PACIFIC BEACH
MISSION BAY
EAST SAN DIEGO
PACIFIC
BALBOA PARK
OCEAN
CBD
LOGAN HEIGHTS
OCEAN BEACH
NAS
NORTH ISLAND
CORONADO
SAN DIEGO BAY
NATIONAL CITY
5
POINT LOMA
CHULA VISTA
SOCIAL TRIPS
RELATIVES
0
1
2
IMPERIAL BEACH
SAN YSIDRO
UNITED STATES
MEXICO

Figure 2. Social trips to relatives from four communities in San Diego.

> actional life; yet the scale and diversity of the city, and the multiplicity of personal networks affording access to a wide array of resources, tell against the development of dependency on a single set of intimates. Having access to many networks enhances the urbanite's ability to conduct transactions in relative privacy and secrecy so far as the members of his other networks are concerned.

Although we know more about maintaining networks of social ties from actual movement patterns, we can also learn how the telephone can influence interaction between two people. The degree to which one substitutes the telephone for travel depends on the occasion and social purpose, but in nearly all cases, the telephone is a frequently used alternative (Wheeler and Stutz, 1971: 373). Palm (1973) suggests that neither physical nor social distance accounts for communicative behavior at the intraurban scale of analysis. Data on telephone traffic is difficult to interpret because the calls are not stratified by purpose.

TABLE 2. NINE SOCIAL TIES YIELD THREE DISTINCT GROUPS OF CONTACTS

Category	Friends Factor I	Neighbors Factor II	Relatives Factor III
Neighborhood	−0.0165	*0.9525**	−0.0023
Children	0.0200	*0.9870*	−0.1296
Work	*0.4893*	0.0722	−0.2544
Church	*0.7421*	0.1286	−0.2051
Club	*0.3014*	−0.3473	−0.5054
Former neighbor	*0.4295*	0.2102	−0.3232
Former schoolmate	*0.8578*	0.0030	−0.3114
Friend	*0.9010*	−0.0622	−0.1946
Relative	−0.3240	−0.1975	*0.08730*
Cumulative Percent of Variance	31.99	55.45	70.79

* Italicized values for categories show membership in respective group.
Source: Stutz, 1973b: 138.

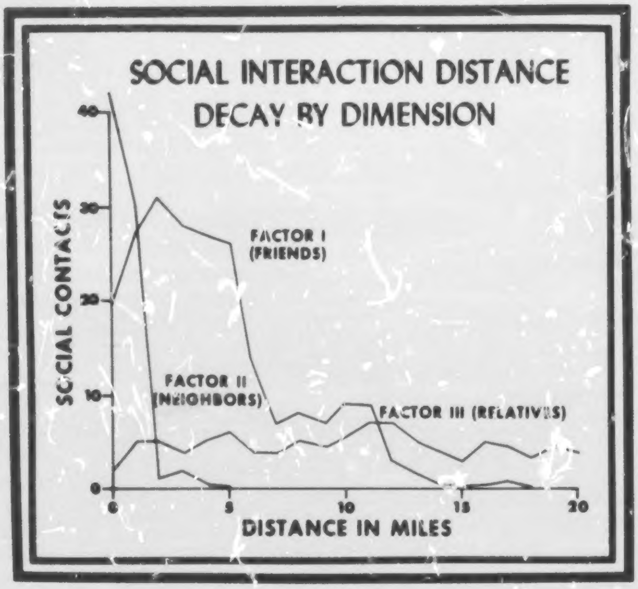

Figure 3. Grouping of social contacts by origin of social tie gives three dimensions of interaction (Stutz, 1973b: 140).

The remainder of this chapter will discuss the geographical manifestations of coordinating and maintaining these social ties as well as the role of the community in this process. This discussion has three parts: 1) a description of some of the common spatial and temporal dimensions of social interaction; 2) an examination of social interaction vis-a-vis the structure of its physical and social environment at the building level, the neighborhood level, and the community level raising questions of the spatial and social determinism of interaction; and 3) an examination of the behavioral underpinnings of social interaction according to some social psychology theories on interpersonal attraction with attempts to put these theories into operation.

Dimensions of Social Interaction

Social travel differs from travel for other purposes in several ways. It differs according to daily and weekly times of travel; to the socioeconomic characteristics of the trip makers; and to the spatial patterns created in the city by the trips themselves. It is well-known that most urban trip making peaks twice daily: around eight o'clock in the morning and again around five-thirty in the late afternoon. Social travel reaches its peak between seven and eight o'clock in the evening. Social trips also demonstrate a smaller peak around midday as people combine social visiting with luncheons either in homes or restaurants (Figure 4). There is a lower frequency of social travel during the early morning hours on weekdays than on weekends. Another low point occurs in midafternoon, followed by a rapid increase up to the evening peak. The strongest hourly change is the abrupt decrease in evening trips corresponding to the closing time for many stores. The weekend pattern differs from weekdays because the major peak is at ten in the morning corresponding to the more relaxed schedules for social outings and for churchgoing. This peak is followed by relatively high frequency throughout the remainder of the day, with a sudden decrease between four and five in the late afternoon.

In a study of Lansing, Michigan, Wheeler and Stutz (1971) noted that social travel frequency differed according to the day of week. Only 37 percent of all social travel occurred on weekdays, whereas the remainder occurred on the weekend, with Saturday having 28 percent and Sunday 35 percent. Apparently about two-thirds of all social travel occurs on the weekends. In a year-long study of a Washington, D.C. suburb, Zehner and Chapin (1974) documented a substantial number of activity systems, keeping a thorough record of the respondents' time budgets. They found a similar social travel frequency, when tabulations of the mean hours spent by the respondents for various activities were recorded by day of week (Table 3). The Lansing data also showed that the distribution of social trips varied by the respondent's age, income, sex, race, and family size. Social travel frequency rises with age up to 21 and slowly declines thereafter (Figure 5).[3] The decline with age is not perfectly smooth and there are slightly higher frequencies for individuals in their late 30's and early 50's. Frequencies continue to rise for individuals between 65 and 68, after which frequencies decline abruptly. This latter group is mostly recently retired individuals who are spending a larger proportion of their time for social interaction, especially in visiting members of the extended family. Compared to all trip-making, social travel makes up a larger share of trips among individuals in the 20's to 40's, after which time social travel becomes a less important facet of leisure time, except for the 65 year old age group. This study

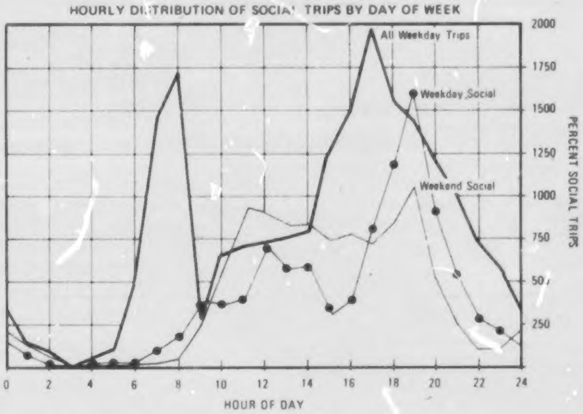

Figure 4. Temporal distribution of both weekday and weekend social trips compared to all weekday trips. Although all weekday trips peak at 8:00 a.m. and at 5:00 p.m., social trips show a peak at 7:00 p.m. with a smaller peak at noon for most weekdays. After 10:00 a.m., weekend social trips are made frequently until 7:00 p.m.

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[3] However, since the data were for vehicular trips only (with the exception of walking and cycling trips to work), walking and cycling trips were not included, probably yielding lower levels of social travel for youth.

TABLE 3. MEAN HOURS OF SOCIAL INTERACTION BY LIVING STYLE

Social Interaction	Weekdays			Saturdays			Sundays		
	Hard[a] Living	Sign.[b] Level	Restr.[c] Living	Hard Living	Sign. Level	Restr. Living	Hard Living	Sign. Level	Restr. Living
Visiting in Home	.39	.20	.53	.54	NS	.44	.61	NS	.58
Visiting in Neighborhood	.34	NS	.25	.20	NS	.20	.46	NS	.25
Visiting out of Neighborhood	.66	.05	.30	1.52	.10	.86	1.31	.20	.77
All Forms of Social Interaction	1.63	.20	1.28	2.85	.20	2.16	3.08	.05	1.82
Percent by day of week	22		24	38		41	40		36

[a] Laboring families, lower than median income, with drinking problems, marital instability, and transiency.

[b] Significance levels: 0.1 or smaller shows hard living and restrained living groups to be quite different for that type of social interaction.

[c] Average or above median income, fewer family "problems," retired.

Source: Zehner and Chapin, 1974: 148.

shows that females make 54 percent of all social trips, although Babchuk (1965) reported that husbands have a greater influence in social friendship formation than wives, especially in selecting the best friends of the family.[4]

In Table 4, each value represents the ratio of the percent of social trips made by persons of a particular group to the percent of the total trips they made. This ratio is referred to as the relative social trip frequency. A relative social trip frequency larger than unity indicates that persons in that group engage in more than an average portion of social tripmaking.

Social travel as a proportion of all travel declines with increasing income (Table 4). In this study Stutz (1973c) correlated social trip frequency and average income for 210 traffic zones in the Lansing, Michigan area and the results yielded a moderate to strong negative relationship. Apparently lower income individuals take a larger proportion of interresidential social trips than do higher

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[4] Tomeh (1974) reports an interesting sidelight on membership in social organizations: ". . . when type of group is analyzed more men than women affiliate in instrumental groups, whereas the reverse is true of expressive groups (including church-related organizations). In instrumental groups men dominate the leadership scene and in expressive groups women are in control (Booth, 1967; Babchuk *et al.*, 1960). These distinctions could at least in part be attributable to differences in early sex role socialization as well as to differential experience and opportunities in later life."

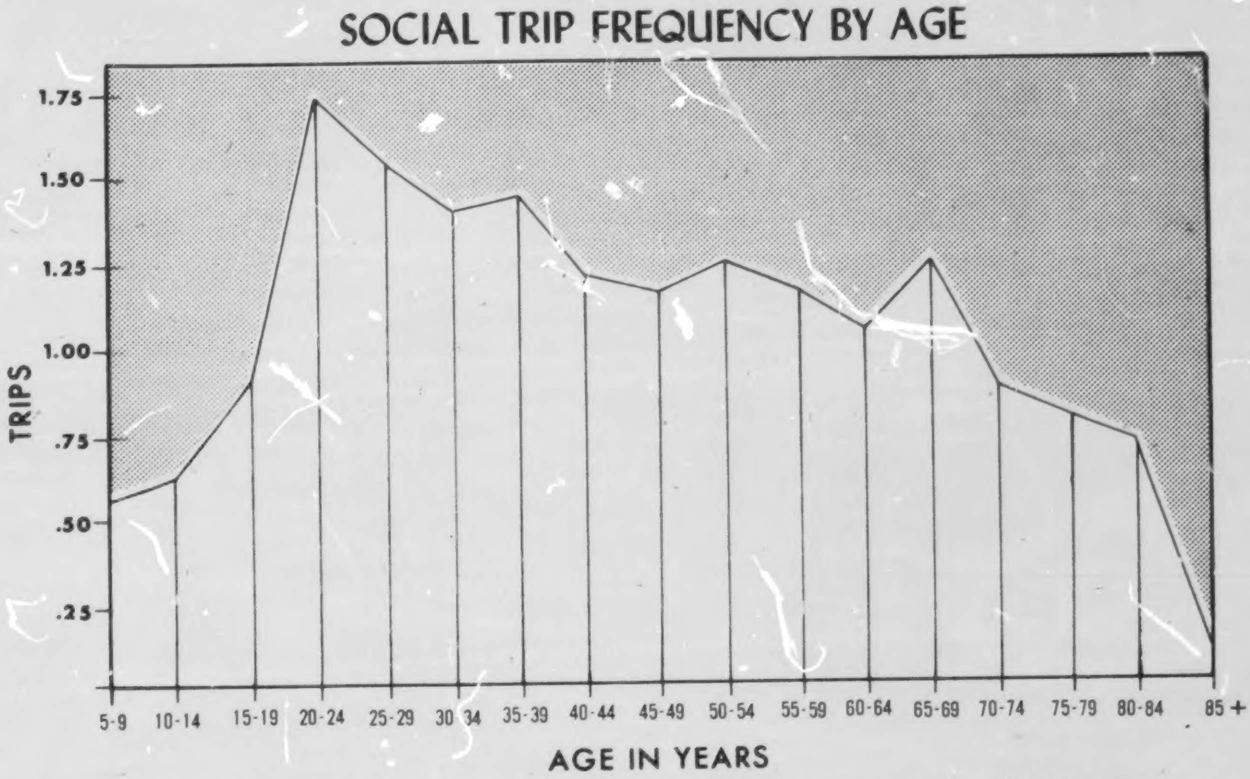

Figure 5. Social tripmaking peaks in the early 20's and thereafter declines. The trip frequency scale is standardized to reflect average tripmaking with a value of 1.00.

TABLE 4. RELATIVE SOCIAL TRIP FREQUENCY FOR FIVE VARIABLES BY DATA CATEGORY

Variable	Relative Social Trip Frequency (RSTF)	Variable	Relative Social Trip Frequency (RSTF)
Income (dollars)		Sex	
		Male	0.85
		Female	1.17
0–	1.46		
1–2,999	1.18		
3,000–4,999	1.15		
5,000–6,999	1.00	Race	
7,000–9,999	1.12	White	0.98
10,000–14,999	0.94	Nonwhite	1.26
15,000–24,999	0.76		
25,000+	0.62		
Household		Mode	
1	1.23	Auto Driver	0.91
2	1.26	Auto Passenger	1.27
3	1.14	Bus Passenger	0.18
4	1.02	School Bus Passenger	0.16
5	0.80		
6	0.62	Taxi	0.90
7	0.98	Truck	0.69
8	0.40		
9	0.97		
10+	0.96		

Source: Stutz, 1973c: 11.

TABLE 6. NEIGHBORHOOD CONTACTS AND URBAN SPATIAL STRUCTURE

Sample Neighborhoods	Neighborhood Social Trips Observed[a]	Neighborhood Social Trips Expected[b]	Structural Barriers[c]
San Carlos	17	20	weak
E. San Diego	21	31	weak
College Heights	26	24	strong
Bird Rock	31	18	strong

Observed $\chi^2 = 13.23$ Tabled $\chi^2 4(.05) = 7.82$*

[a] Number of regular social contacts within the neighborhood that the interviewed families reported.

[b] Number of regular social contacts within the neighborhood that would be an average amount without accounting for barriers present.

[c] The presence of features such as canyons, lakes, or freeways that constrain spatial human interaction.

* Because the observed difference or chi square (χ^2) is greater than the tabled χ^2 value for four levels at .05 significance (13.23 vs. 7.82), the barrier effects are important in limiting social visiting.

Source: Stutz, 1973b: 141.

income groups. Two more recent studies tend to confirm this pattern. Tardiff (1974), in a study of West Los Angeles, found that when various socioeconomic variables were matched against trip generation for social visiting only, the income variable was significant in that it was found to be strongly negative. Unlike previous research linking higher trip making with income, other variables were more strongly associated with travel than levels of socioeconomic status in Tardiff's study. In Tables 3 and 5, Zehner and Chapin (1974) report that "hard living" families, with generally lower incomes than "restrained living" families, were from forty to sixty percent more active in various forms of social interaction than were restrained living families. Table 6 summarizes the findings for all discretionary activity in their study. One possible explanation, which may account for a portion of the difference in social trips between low and high income individuals, is that low income individuals substitute interresidential social interaction for other leisure activities requiring greater cost. Lower income individuals have greater kinship interaction than higher income individuals and this interaction is usually home-based.

Social trip frequency by household size shows that smaller households make more social trips relative to total trips than do larger families (Table 4). Smaller families, compared to larger ones, have fewer resources to fulfill their leisure time and companionship demands. One cannot explain this relationship clearly although it probably involves a complex set of interrelated variables which could best be examined by individual level research.

Most people make their social trips by automobile rather than by mass transit, partially because most social trips take place in the evening and because the automobile is comfortable, convenient, and provides door-to-door service. On social trips, people tend to travel in groups of two or more, as data show a higher relative frequency of auto passenger than auto driver trips.

Determinism of Social Travel

The title for this section is meant to be provocative. After examining some of the material one should be able to determine if the title is a misnomer. One possible answer might be suggested: "We shape our buildings, and afterwards, our buildings shape us," wrote Winston

TABLE 5. MEAN HOURS OF FREE TIME BY LIVING STYLE

Day of the Week	Class of Activity	Hard Living n/N	$\bar{X}$	Restrained Living n/N	$\bar{X}$	Sign. Level
Weekdays	Rest and Relaxation	52/139	.71	206/499	.95	.10
Saturdays	All Discretionary Activity	74/74	8.98	200/203	7.60	.05
Sundays	Social Interaction	45/64	3.08	137/237	1.82	.05
Sundays	Rest and Relaxation	22/64	.84	113/237	1.30	.10

n is the number participating in the activity, N is the sample size, and $\bar{X}$ is the arithmetic mean.
Source: Zehner and Chapin, 1974: 155.

Churchill upon reopening the repaired English House of Commons that had been damaged by wartime bombings.

Today there are constant reminders of how man has an impact on the earth. In this section we shall explore the impact of the natural and man-made environment on human social behavior. Can the planners and architects who draw plans for neighborhoods and who arrange people into small spaces, plan viable and successful neighborhoods and communities for people to live healthful lives and to interact socially?

Several studies of social contact and interaction within restricted areas such as married student housing units and small neighborhoods have revealed that short distances increase the probability for two people to meet and establish friendship patterns. The architectural structure and the geographical arrangement of buildings, front doors, and even sidewalks, hedges, and washing lines act to bring certain people together, and thereby enhance the likelihood of their future interaction. Caplow and Foreman (1950) called attention to the strong role that distance plays in social contacts among married couples in university housing. Although they found no evidence of the influence of status on social contacts, probably because of the homogeneity of the population, Barnlund and Harland (1963) found status to be an important force in the communication patterns among students in campus dorms. Their findings showed that although architecture and geography may determine the frequency of interaction among individuals in the primary stages of social organization, other factors such as prestige can polarize interaction along status lines even in the presence of adverse physical conditions. Newcomb (1961) has carried out the most detailed research, over a two-year period, on the interaction of a small group of college men residing in a rooming house. By focusing on personality variables and changing attraction within the framework of the "theory of balance," he found that proximity was a significant factor in the acquaintance process.

Studies are beginning to emerge on the role played by urban structure on movement (Clark, 1971; Horton and Reynolds, 1971; Rushton, 1971a; Stutz, 1973b). At the neighborhood level, natural and man-made barriers such as topography, rivers, railroad tracks, and highways inhibit information flow and accessibility and limit persons' movement territories. These barriers, both perceived and actual, help to divide effectively large cities into functional communities, not only for social travel, but also for acting out our lives.

Microscale Social Determinism

One study of social interaction dealt with a large group of newly constructed married housing units at the Massachusetts Institute of Technology for recent veterans of World War II who were completing their education (Festinger *et al.*, 1950). It examined the social travel and visiting patterns within two planned residential areas. The first area, called Westgate, consisted of 62 apartment buildings arranged in elongated quads connected by sidewalks and facing away from the streets and parking area (Figure 6). Social interaction and friendship formation were directly related to the physical separation of housing units. On the average, visiting patterns and close friendships were found on every quad and the degree of interaction declined as a strict function of distance away from each household. This interaction ranged from a close friendship with those sharing the same sidewalk (occasionally it was an antagonistic relationship), to only an acquaintance with others in the same building and quad. Mere hand waving but rarely anything more intimate was extended to those living on the far edge of the quad, and there was complete ignorance of others who may have been recognized as Westgate residents, but whose location within the living complex and whose activity pattern did not warrant the rendering of special familiarity. The families who were most often without friends in the residential development were those whose units faced a side yard or the street, and hence, were peripheral to the mainstream of person movement. Also, families who had working wives or in which both members were gone most of the day showed similarly lower social interaction.

The results of this study also showed that commonly held opinions and political viewpoints were a function of the personal acquaintanceship and spatial proximity of those in a clique. The stronger the clique, the stronger the opinions and, in general, the fewer deviant views maintained. More recently, both political scientists and geographers have documented similar results when observing neighborhood social visiting behavior on voting patterns. Putnam (1966) has reviewed three ideas put forth to explain commonly shared local political attitudes. These are community identification, community standards, and the social interaction theory suggesting that community influence is mediated primarily through the multiple personal contacts among members of a community. Such social interaction within a community would tend to support political attitudes commonly held by community members, and to suppress deviant views.

WESTGATE COMMUNITY

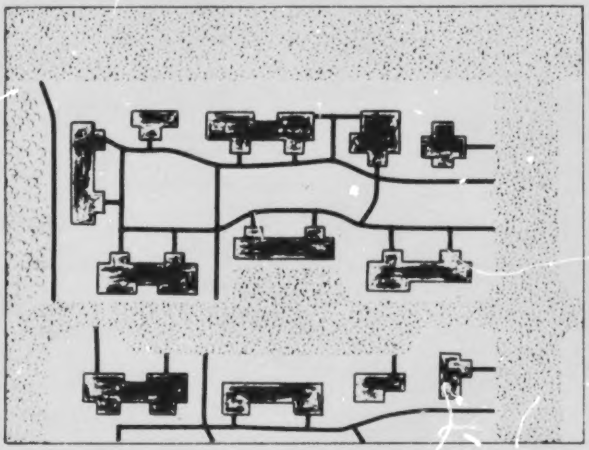

Figure 6. Westgate community configuration at M.I.T. (Adapted from Festinger *et al.*, 1950: 14).

WESTGATE WEST APARTMENT BUILDING

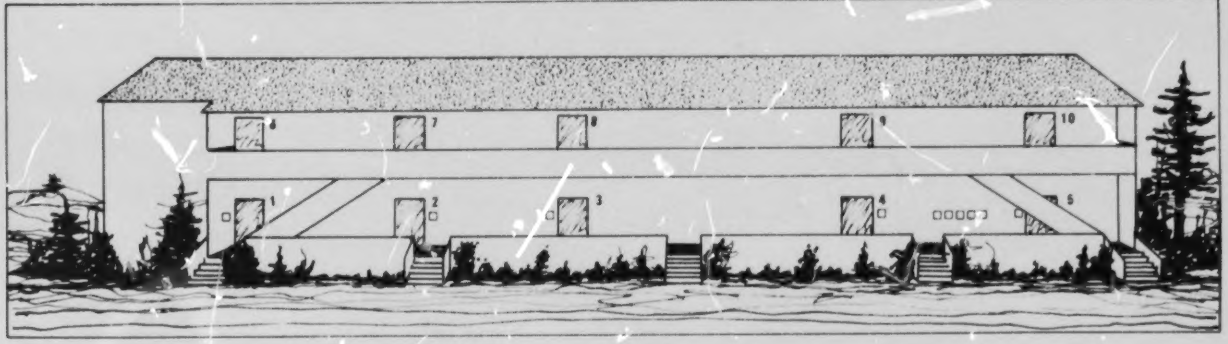

Figure 7. Westgate West apartment building housing married students at M.I.T. after World War II. The location access points were important in friendship formation within the building (Adapted from Festinger *et al.*, 1950: 36).

Like Putnam, Foladare (1968) and Cox (1968) found support for the social interaction hypothesis.

In another M.I.T. housing development that Festinger *et al.* (1950) studied, they observed social interaction within buildings of Westgate West rather than between buildings. Here functional distance was the most important factor determining social visiting. The units had two stories with two staircases leading to the second floor (Figure 7). The residents of the first floor who were, in physical terms, equally distant from those on the second floor, did not share equally the friendships of those on the second floor. The pattern of person movement gave the families occupying the units next to the stairs on the lower level a greater chance to meet and become friendly with those on the second floor. Since all of the residents had to enter and exit via one of the staircases regardless of their locations on the second floor, and since those living on the first floor did not frequently go to the second floor, the spatial friendship bias on the first floor was not equally shared by those on the second floor. This type of distance has frequently been called functional distance.

Another study of the role of functional distance on social interaction analyzed ninety residents of post-World War II housing in Braydon Road, England (Kuper, 1953). The houses were situated so that on either side two identical living units were separated by a center wall (Figure 8). The wall's position gave some privacy to adjacent neighbors but each could easily become familiar with the other's social makeup if desired. However, these adjacent units had front doors well separated from one another and functionally closer to the house next door because of the configuration of sidewalks (Figure 9). Although adjacent neighbors were physically closer to one another and could be in contact much more frequently, it was the side neighbors that developed the most intense social relationships, both friendly and unfriendly. The placement of doors and sidewalks thus enabled people to meet on a common territory where they could develop social relations. The common sidewalk and yard were thought to be important factors of

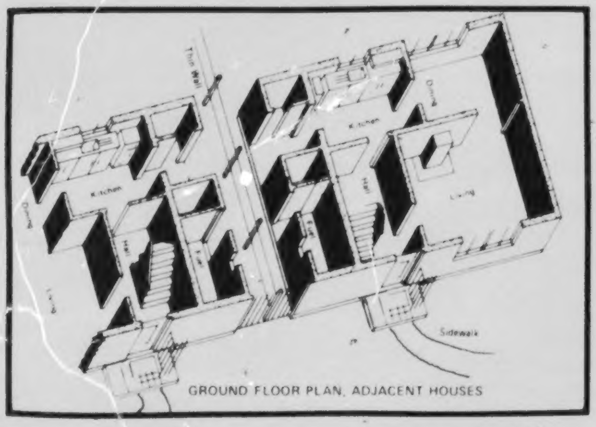

Figure 8. Braydon Road, England. Married student housing (Adapted from Kuper, 1973).

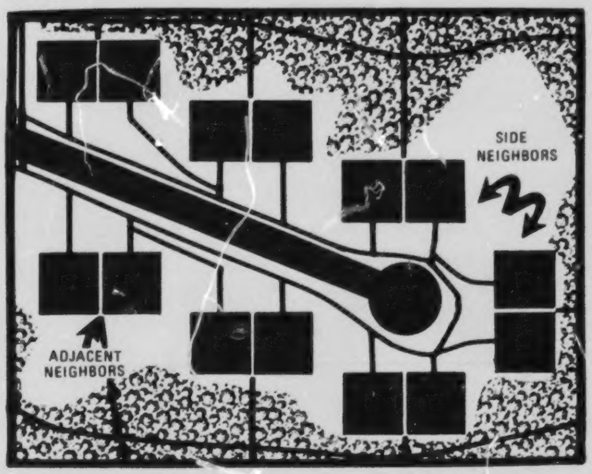

Figure 9. Braydon Road, England. Housing units. In spite of the close proximity of adjacent neighbors, side neighbors became more socially involved because of the functional distance and common turf associated with the configuration of walkways (Adapted from Kuper, 1953).

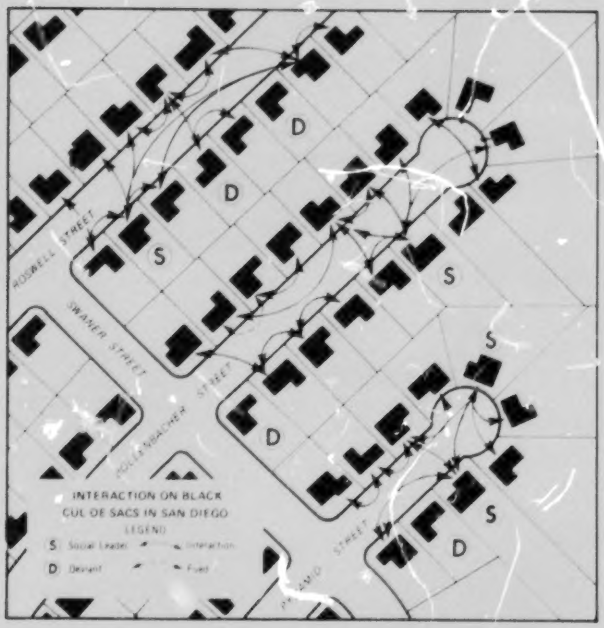

Figure 10. Interaction of blacks is limited to the local street on which one lives. Usually at least one person acts as a social leader.

unity and defensible space and led to positive and negative relationships for side neighbors.

A study by Johnston (1974) on microscale spatial behavior and interaction in Christchurch, New Zealand, cul-de-sacs gathered sociometric information very similar to that in the M.I.T. studies. Each person on the cul-de-sacs was asked to name the three most important social contacts living on the same street. Many were unable to name three. After analyzing these data, there was clear evidence that both length of residence and attitude toward the street were directly related to degree of membership in the friendship network. On most streets, the longer the residents had lived there and the more they liked their neighborhood, the more linked they were. Johnston concludes that this limited analysis of eleven sociometric networks has suggested that distance, social group membership, and attitudes all influence participation rates for friendship within small, "closed" streets. The distance effect, it would seem at this stage, is most influential on the actual choice of friends. A similar study of social participation by middle-class black residents living on cul-de-sacs in San Diego produced almost the same results (Figure 10). Working wives were thought to be less popular than their nonworking counterparts. In fact, the opposite was the case. The explanation for this is not clear, although the community had a relatively high level of membership in formal organizations by nonworking wives. Since blacks are not as likely to gain prestige and power in the organizational life of American society, they compensate by increased rates of participation in formal organizations. This high level of formal associational membership among blacks in middle-class cul-de-sacs allowed the working wives to be as active in the local neighborhood as nonworking wives.

Neighborhood Level Spatial Determinism

Not only can subtle influences such as the simple location of buildings, doors, and walkways increase a person's knowledge and exposure to others, but also more pronounced physical barriers can cause similar results for an entire neighborhood. One recent study examined the effect of major physical features on social visiting patterns in four neighborhoods in San Diego, California (Stutz, 1973b). This study found that topography had a strong barrier effect which limited areas of interaction. San Diego occupies a coastal plain and adjacent upraised beach terraces. The upland terraces are deeply dissected in many places by large, often steep canyons which strictly delimit communities and neighborhoods (Figure 11). These canyons are often too narrow to be used for anything but highways, thus increasing their barrier effect.[5]

After controlling for social, ethnic, and family status, Stutz examined four neighborhoods, each with varying degrees of structural barriers. Two of the four neighborhood barriers to interaction on more than two sides, College Heights near San Diego State University, and Bird Rock near the Pacific Ocean, displayed a greater than expected amount of interaction within each respective neighborhood (Table 6). The two neighborhoods with barriers to movement on less than two sides, San Carlos, in a new suburban area of the city, and East San Diego, in an older section, had a smaller than expected amount of social interaction within their confines. But arterial streets, open tracts of land, as well as differing land uses can have similar effects on the interaction.

Another study at the neighborhood level brings into

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[5] Some canyons have been raised to the terrace level as sanitary land fills. Only now are planners beginning to see the desirability of preserving canyons as parks and open spaces because they are the only areas that have been skipped over by the urban sprawl.

SAN DIEGO PHYSICAL LANDSCAPE

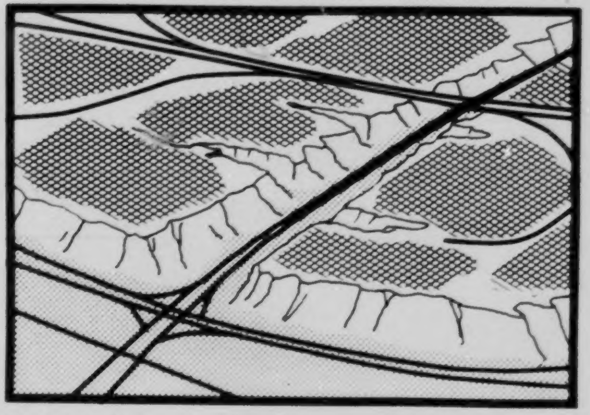

Figure 11. Former beach terraces, upraised from the coastal plain and strongly eroded, demarcate human settlement. Freeways often occupy the narrow canyons.

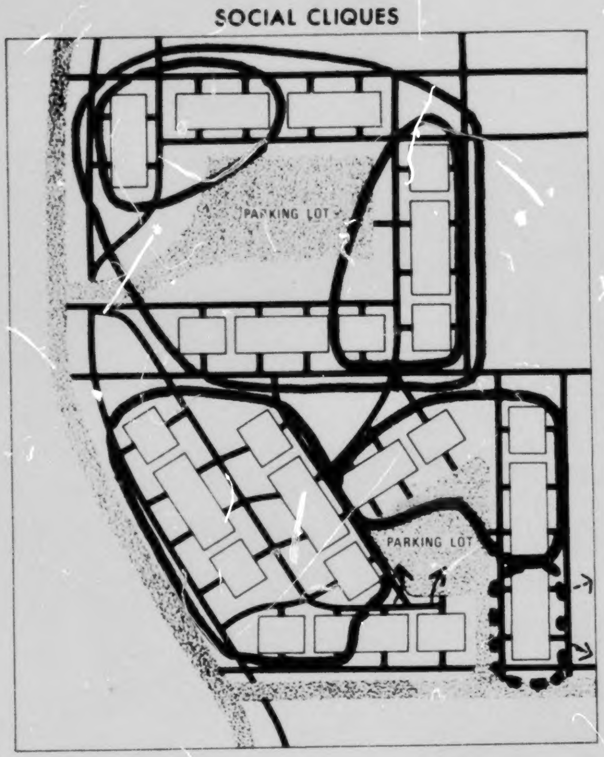
SOCIAL CLIQUES
PARKING LOT
PARKING LOT

Figure 12. Building configuration and social cliques (Adapted from Whyte, 1957).

play another factor of interest—residential turnover. This study examines Park Forest, Illinois, a suburb south of Chicago. Whyte's (1957) famous book, *The Organization Man*, describes the social travel behavior of the young executive and examines two types of housing: two-story garden apartments and single family dwellings. Whyte illustrates how the location of buildings, stoops, play lots, and parking lots, as well as simple propinquity can determine the social cliques in which a person was likely to be a member (Figure 12). Apparently, once people formed social visiting patterns, these tended to be almost constant although there was a twenty percent turnover each year in the neighborhood. This was also confirmed by the neighborhood social activities. These activities had a distinct neighborhood effect that is familiar to students of diffusion studies and consumer research (Figure 13). When Whyte returned to Park Forest three years later to interview residents in the same neighborhood he found almost the identical groupings of houses into the social visiting patterns as before, despite a residential turnover of about sixty percent and changes in the social activities. Apparently the spatial layout of the neighborhood had a permanent effect on friendship formation.

Conditions of Spatial Determinism

There are strong cases, some of which have been noted above, for a theory of spatial determinism. And yet, examples exist in social visiting studies of principles of spatial determinism that have been rejected. One such example of where distance was not found to be instrumental in friendship formation is Gans' (1967) study of a suburban tract of homes in Levittown, New Jersey. And yet, in Gans' (1962b) famous study of the West End in Boston, determinism, probably more social than spatial, played an important role in the inhabitants' life styles. The relationship between spatial and social propinquity may be one of the necessary ingredients creating determinism. By controlling for social, ethnic, and family homogeneity, one automatically insures a potential for interaction. Kanter (1968) and later Michelson (1970) describe the conditions under which spatial determinism operates. Propinquity and functional distance are two important factors for the establishment and maintenance of social ties when there is a high level of perceived homogeneity among the participants. Another important factor is mutual aid. Both of these factors were present in the married housing unit social interaction studies, and are also present in new tract developments as well, where people generally share the same socioeconomic level, and many have similar family life cycles. In fact, the idea that all of the residents are very similar, and therefore very friendly, is a favorite sales technique in many new housing developments. Mutual aid, such as borrowing tools or providing babysitting

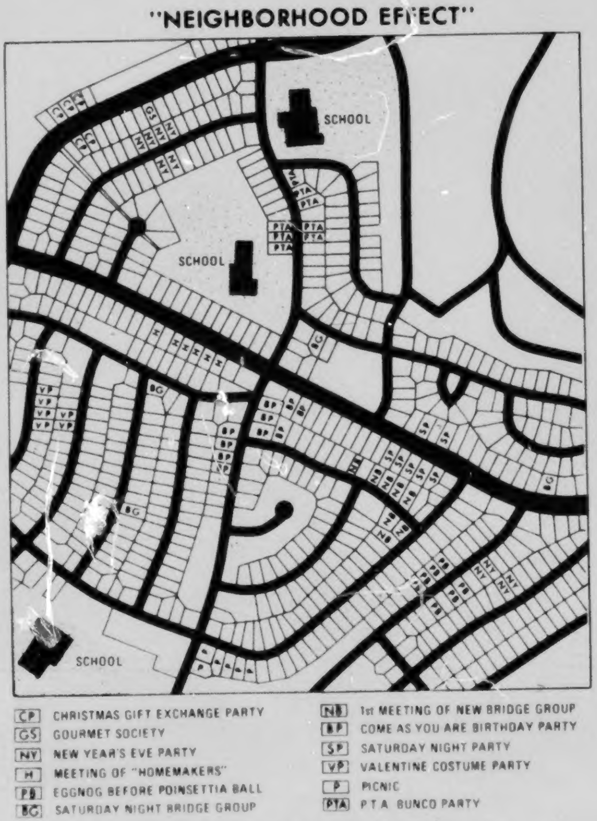
"NEIGHBORHOOD EFFECT"
SCHOOL
SCHOOL
SCHOOL
CP CHRISTMAS GIFT EXCHANGE PARTY
GS GOURMET SOCIETY
NY NEW YEAR'S EVE PARTY
H MEETING OF "HOMEMAKERS"
PB EGGNOG BEFORE POINSETTIA BALL
BG SATURDAY NIGHT BRIDGE GROUP
NB 1st MEETING OF NEW BRIDGE GROUP
BP COME AS YOU ARE BIRTHDAY PARTY
SP SATURDAY NIGHT PARTY
VP VALENTINE COSTUME PARTY
P PICNIC
PTA P.T.A. BUNCO PARTY

Figure 13. The neighborhood effect of social activity groupings in Park Forest, Illinois. Proximity is an important factor in which activity will be selected (Adapted from Whyte, 1957).

TABLE 7. FREQUENCY OF NEIGHBORHOOD CONTACTS BY HOUSING CHANGE

Housing Change (moved from)	Frequency of Neighborhood Contact Percentage of Total Contacts for Each Group Once Per Week or More	 Several Times Per Month or Less	 N
House to House	65.13	34.87	67[illegible]
House to Apartment	74.21	27.59	174
Low Rise to House	62.28	37.72	289
Low-Rise to Apartment	70.61	29.39	228
Apartment to House	45.[illegible]	54.75	179
Apartment to Apartment	59.60	40.20	602

Source: Michelson, 1974: 165.

services, is important for new arrivals to a neighborhood, especially during the getting-settled period (Michelson, 1970). Mutual aid among families may actually grow with the length of time spent in a neighborhood (Shulman, 1967).

Within the available resources, most families will attempt to minimize the social and economic distance between themselves and their new neighbors by selecting the residential area that fits their level and style of living (Park, 1924; Duncan and Duncan, 1955). For neighborhoods in transition and for public housing projects, there is less perceived similarity and sharing of mutual aid. The resulting level of neighboring is at a much lower level. Michelson (1974) confirmed this in Toronto where he compared the neighboring of residents who were about to move to a new dwelling. The group in the high-rise apartments showed a lower level of social visiting within the neighborhood (last two rows in Table 7). Here residents view their neighbors as being substantially different from themselves (Hartman, 1963). Also, in public housing projects, unless tenants have strong mutual problems which tend to unite them, there is little need for mutual aid (Bellin and Kriesberg, 1965). The living units are usually maintained and owned by some impersonal housing authority which has not created a favorable social or economic climate. This further deteriorates the concept of community and social interaction. Vandalism and theft by residents become more easily rationalized. This circular and cumulative process has led to higher vandalism rates in some larger buildings where defensible space is all but nonexistent, and in others, such as Pruitt Igo in St. Louis, to their total destruction. Apparently neighborhood population density plays a role in social visiting rates, which is related to neighborhood maintenance (Figure 14).

Similarity of life cycle stage among families can lead to a strong sense of perceived similarity. Children from different families who are the same age and who play together can bring adults into friendship through their play habits and shared territories. The presence of children and their mutual exchange can overcome differences including different economic status, for mothers who would have little else in common (Athanasiou and Yoshioka, 1973).

Social Determinism

Other than the personality variables important in social interaction for joint attraction, there is probably no single factor that is as important in friendship formation as the social class of the participants. Social class is considered to be a set of structures in which there are values, obligations, and freedoms associated with each status level. Social distance is a concept long used in describing the process of invasion and succession of neighborhoods (Burgess *et al.*, 1925). It refers to the degree of perceived separation between different levels of status. When applied to potential social contacts, it refers to the way in which one individual perceives another individual as a possible friend. This perception is conditioned by many sociopsychological elements, and the way the elements interrelate is based on the individual's value system. Toffler (1969), in his provocative best seller, *Future Shock*, suggests that individuals with ample leisure time associate with others according to life style, cultural taste, or preferred recreational activity, rather than by occupation or income. Yet, other research suggests that covariants of the preferred activity are occupational class (Burdge, 1969; Noe, 1971).

Even though the images and perceptions that people have of others will be partly idiosyncratic, there is some evidence to suggest that a common impression towards others exists according to social class (Lynch, 1960; Sonnenfeld, 1969). Because social distance is a com-

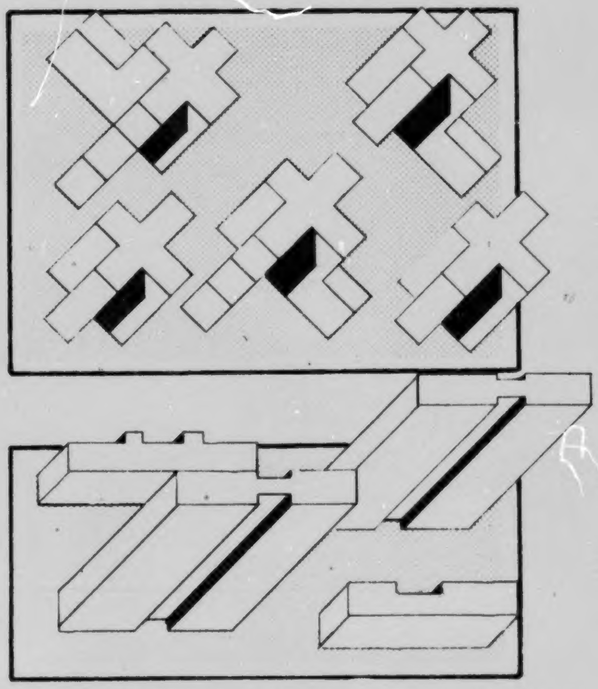

Figure 14. Social visiting is likely to be greater in the top housing development (Brownsville) than in the lower (Van Dyke): concepts of community are better established because of more personalized territories and vandalism is likely to be lower as well.

posite variable and is based on numerous, mutually perceived characteristics, it has been difficult to measure (Laumann, 1966; Beshers and Laumann, 1967; Brown and Horton, 1970). Long standing and more recent research has pointed out a rank ordering of groups on the basis of perceived social reward and social distance characteristics. The ranked groups in increasing order of perceived social distance are family, friends, and neighbors (Bogardus, 1926; Axelrod, 1965). Specific studies of neighborhood social relations have been carried out for both formal and informal associations. One finding is that the concept of social distance is associated with spatial distance. Laumann (1966) documents the clear connection between intimate social interaction and the urban stratification system. "Occupational prestige appears to be the major determinant of an individual's subjective social distance preferences . . ." says Laumann, who also adds . . . "comparable occupational status appears to be the main factor in determining with whom he actually engages in a variety of social relationships."

Social class may also play a role in the length of the social trip. In a study of Lansing, Michigan, Smith *et al.* (1954) noted a tendency for neighborhood social interaction to increase from the city center to the periphery. They found the incidence of highest social visiting on a local level in high socioeconomic areas. Residents of low socioeconomic areas established friendships largely through the neighborhood as well. The same city was revisited 16 years later (Stutz, 1972) and except for the extreme groups, social trips were, on the average, shorter for higher occupational groups (Table 8). According to interviews, both higher and lower classes reported they had established friends through the neighborhood. Residents of low occupational classes stated that former neighbors comprised the majority of friendships. The discrepancy in social travel length according to occupational class was explained by the higher rate of residential mobility of low income groups, who had developed social ties in their former neighborhoods and maintained these ties, even though it meant longer social trips.

TABLE 8. MEAN SOCIAL TRIP LENGTH AND INTERRESIDENTIAL SEPARATION BY OCCUPATIONAL CLASS (LANSING, MICHIGAN, 1970)*

Occupational Class	Social Trip Length (km)	Residential Separation (km)
Laborers	3.74	1.66
Service workers	4.91	2.18
Operatives	4.72	2.63
Craftsmen and foremen	4.60	2.26
Clerical and kindred workers	4.21	2.47
Sales workers	3.92	2.71
Managers	3.69	3.40
Professionals and technical workers	4.02	3.24

* The average separation of members of each occupational class was measured to control for the possibility of higher densities in the high income areas, although all observations suggested that the opposite was the case. This was accomplished by computing the minimum interresidential separation of classes by using a linear programming model and allocating supply and demand points (households of a given class) on the basis of census tracts.

Source: Stutz, 1972: 845.

Traditionally distance and social class have proven to be important in social travel leading to mate selection. Bossard's (1932) study, along with several others, suggested that marriage choice was related to residential propinquity (Boult and Janson, 1956). There are two basic theories of mate selection as it relates to distance. First, every individual has a spatially restricted field of eligibles, and the contact among eligibles by the selector may be random, except that potential interaction is inversely related to a time-cost function, which in turn is closely related to residential distance (Figure 15). The marriage decision results from a period of social travel and interaction, and the greater the amount of potential courtship interaction the higher the likelihood of marriage choice. Therefore, the closer the distance, the higher the probability of frequent contact, and the greater the probability of marriage (Morrill and Pitts, 1967).

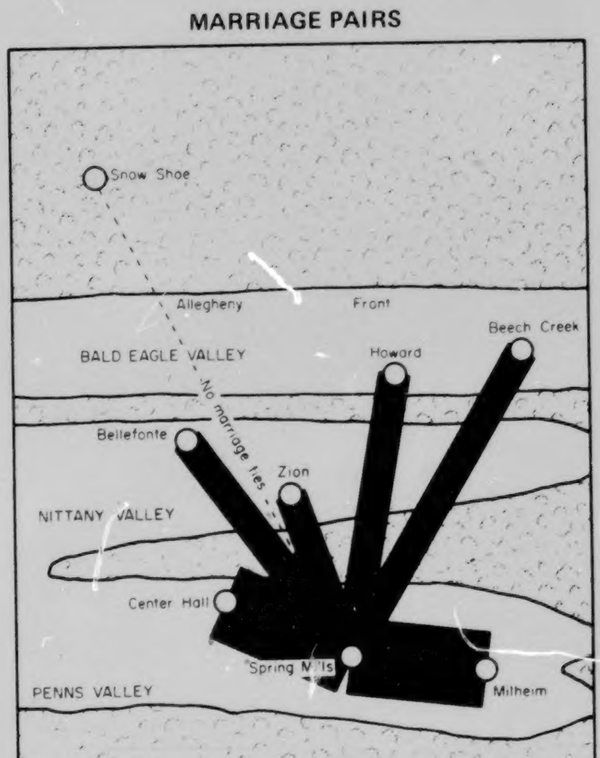

Figure 15. Marriage choice is closely related to distance as shown by this example from Pennsylvania. Graduated line segments show the volume of pairs (Adapted by Abler, Adams, and Gould, 1971: 404 from *The Local Community: A Handbook for Teachers*, copyright by the Association of American Geographers [High School Geography Project], New York: Macmillan, 1968, 1971, p. 173).

Secondly, various cultural and status groups form fields of eligibles which are often clustered residentially. Although the chances are high that one will choose a mate from the same or similar socioeconomic stratum, the spatial concentration of these eligibles also explains the inverse association between distance and the probability of marital choice. In Norway, where propinquity and likeness of spouses (homogamy) were independent of one another, Ramsoy (1966) found that the probability of marriage varied directly with the degree of similarity of the occupational status of the bride and groom, and inversely with their residential separation.

Spatially and Socially Determined Communities

Groups of households compose neighborhoods, and groups of neighborhoods, communities. Given the results of studies reviewed above, in which social relations are based on propinquity, and given that individuals attempt to sort themselves out into homogeneous areas, it is possible that entire communities can be identified on the basis of social relations and visiting patterns. Urban researchers have for some time attempted to define the concept of neighborhood or community. But these areas are not easily recognized (Wolpert *et al.*, 1972), and there has been no general agreement as to a definition of community (Bourne, 1971). Definitions of community or neighborhood have ranged from lengthy and multifaceted descriptions (Schnore, 1968) to oversimplified one-phrase definitions (Bowden, 1972); and none has provided any method for determining the boundaries of a neighborhood or community. Given this inherent spatial theme, geographers have contributed little to the areal delimitation of these social spaces. The main approach in geography has come from the factorial ecologists who define communities as a spatial expression of the social characteristics of a city's population, but it is doubtful whether the resulting areas function as true communities. Other concepts of community have been based on an area's historical evolution (Ward, 1968), its ethnic diversity (Rose, 1970), or its unique location and landscape (Gans, 1962b).

There are unique characteristics and processes associated with that structure known generally as a community. The examination by Hillary (1955) of 94 different definitions of community used by sociologists, reveal strikingly common dimensions. Sociologists agree that the concept of community contains three major attributes: 1) people living in a geographic area who, 2) socially interact, and who, 3) have one or more common ties (Hillary, 1955). Sociologists most frequently emphasized social interaction because attributes 1 and 3 are reflected in attribute 2, social interaction. Social interaction exhibits a distance decay property, suggesting that communities' areal parts are likely to be contiguous, i.e. attribute 1; and individuals have a greater probability of interacting if they have similar characteristics, i.e. attribute 3.

More recent work has also stressed the importance of interaction in defining community (Gould and Kolb, 1964; Arensberg and Kimball, 1965). Perhaps the most deliberate attempt by a geographer to define a community or social space also resulted in identifying three attributes: 1) formal characteristics, or mapped areas of socioeconomic similarity, 2) functional characteristics, or points that serve as major foci of social activity, and 3) circulatory characteristics, or the lines representing flows of people (Buttimer, 1968). Attributes 2 and 3 are based on interaction. According to this and other work, communities are more properly defined by human interaction patterns than by the simple similarity of social characteristics. Yet, interaction is the product, in part, of physical, functional, and social distance. Social characteristics and physical attributes do not always coincide and there has been difficulty in combining the two. Lee, the British social psychologist, states:

> The major difficulty for the social scientist seems to be the elusiveness of neighborhood. He cannot capture its whole in the net of a single concept. If he isolates it as a piece of territory, he often finds little or no correspondence with human behaviour; if he concentrates instead on social relationships he finds that these do not synchronize with geography. Yet he persists in thinking that the two components are somehow crucially interdependent (Lee, 1970b: 241).

Two recent attempts centered on interaction have been made to combine both the physical and social elements of neighborhoods (Stutz, 1973a, 1974a).

Travel patterns display temporal descriptions of communities. Social visiting travel patterns within urban areas produce a composite of overlapping friendship territories which define functional boundaries to urban "interactance" communities. Stutz (1973a) determined community boundaries in Northern San Diego on the basis of overlapping friendship territories by regionalizing the common origins and destinations of social trips. In order to accomplish this, he constructed and analyzed an origin-destination matrix, which is a table showing the starting and ending points of inter-residential social trips in the study area of northern San Diego (Figure 16). Census tracts used for population tabulation, each containing about 6,000 people, provided the starting and ending points. Most of the census tracts clustered into one of the discernible patterns referred to as interactance communities because of common starting and ending points for trips. Some communities entered less strongly than others because of the more diffused nature of their travel patterns (Table 9). The size and composition of the communities are a function of the physical environment, of social characteristics, and of the interaction of residents as Hillary (1955) and Buttimer (1968) suggested.

Stutz (1973a) defined the communities on the basis of trip flows extracted from trip survey data. The community boundaries resulting from this technique were independent of human judgment. The spatial patterns of the census tracts comprising each of the eight interactance communities show both contiguity, or the effect of distance, as well as economic status, or the effect of occupant similarity, on social interaction and community identification. However, San Diego is well dissected by major physical features and this technique of social community identification may work less well in other

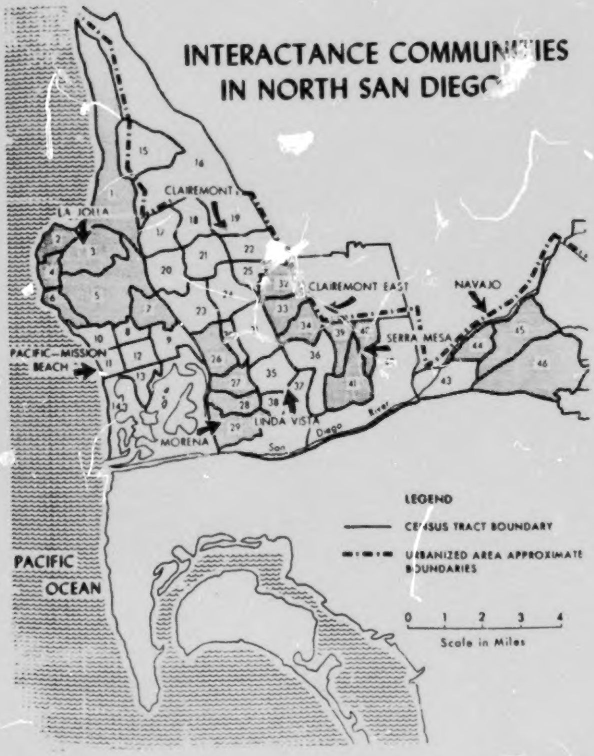

Figure 16. Spatial clustering of travel forms intraurban social spaces (Stutz, 1973a: 259).

cities. In fact, even in this study, areas that are less well defined structurally are weaker (Table 9). The seven census tracts that correspond to the La Jolla community of San Diego have the strongest grouping and are the most dissimilar from the other tracts in terms of interaction characteristics. La Jolla is the most clearly defined area in San Diego, because of its locational characteristics and its historical evolution. An objective, quantitative capability designed to identify communities, such as the one employed here, might be an effective contribution to the planning process. Yet, a community such as La Jolla is easily identifiable without such a capability. The value of such a capability is more easily seen when examining large, less naturally defined areas. Examples of this type of community in northern San Diego are Clairemont, Clairemont East, Serra Mesa, and Linda Vista, all of which are located on the flat upraised mesa north of the San Diego River. Interactance community boundaries both comprise larger areas than do some of the San Diego City Planning Department's named communities, as well as truncate other named communities. The implication here is that the named districts have been established intuitively, according to the spatial attribute only, and do not accurately reflect the boundaries of the underlying interactance communities themselves. The degree to which these interactance communities parallel actual city planning department communities, the importance of factorial ecological variables (social status, ethnic status, etc.) in this delimitation, and the policy implications of social travel on community definition will be examined later.

Social Travel Behavior

Social interaction is probably the most important set of relationships a person can develop in a lifetime. Social interaction not only offers an important goal of everyday living, it gives order and meaning to activity patterns and helps to crystallize an individual's personal cognition of society and environment. There is little wonder why an emphasis on improving social relationships between people currently exists. Harris' (1969) bestseller, *I'm Okay, You're Okay,* attempts to accomplish this goal. It has led to a wave of new courses on transactional analysis being offered across the country. An earlier book by Berne (1964), *The Games People Play,* details the multiplicity of ways that people transact and avoid transaction. The sum of these transactions and information flows forms a system of checks and balances to one's idiosyncratic fantasies and perceptions of oneself, of others, and of one's environmental setting. One's set of social acquaintances offers a broad set of viewpoints, and like the nuclear family, the structure,

TABLE 9. SAN DIEGO COMMUNITIES COMPOSED OF CENSUS TRACTS WITH HIGH DEGREE OF AFFINITY FOR ONE ANOTHER BASED ON SOCIAL TRAVEL*

Census Tract	Community I La Jolla	Community II Clairemont	Community III Pacific Mission Beach	Community IV Morena	Community V Clairemont East	Community VI Serra Mesa	Community VII Linda Vista	Community VIII Navajo
1:	0.738	20: 0.798	10: 0.418	26: 0.506	32: 0.429	39: 0.763	35: 0.789	44: 0.464
2:	0.573	21: 0.671	11: 0.801	27: 0.401	33: 0.851	40: 0.824	36: 0.430	45: 0.404
3:	0.864	22: 0.474	12: 0.427	28: 0.598	34: 0.670	41: 0.492	37: 0.480	46: 0.426
4:	0.475	23: 0.426	13: 0.808	29: 0.505	—	—	—	—
5:	0.793	24: 0.842	14: 0.7[illegible]	—	—	—	—	—
6:	0.831	25: 0.502	—	—	—	—	—	—
7:	0.448	—	—	—	—	—	—	—

* Clustering of census tracts was accomplished by analyzing 175,000 trips from an origin-destination matrix. Only variables with loadings > 0.400 are shown for each factor (community). Each value for a census tract represents its association with a community.

Source: Stutz, 1973a.

form, and meaning attached to acquaintances becomes the structure, form, and meaning for many of a person's attitudes, perceptions, thoughts, and feelings. To some degree, the group with which we interact becomes the group with which we must closely identify. The understanding of social interaction can lead to a better understanding of human interpersonal attraction and spatial behavior, since it is a large portion of both.

There has not been an abundance of studies dealing with the social nature of interaction, and much less on the causes of it. Prior work has dealt with identification of friendship choices in relation to the compatibility of need (Johnson, 1953; Winch *et al.*, 1954) or value compatibility between two participants (Fiedler *et al.*, 1952; Thompson and Nishimura, 1972). More recently others have approached friendship in terms of ego contemplation and needs compatibility rather than as a function of need similarity (Thibaut and Kelley, 1959; Nelson, 1966). Social psychologists have studied behavioral attributes such as authoritarianism and affiliativeness in establishing acquaintances and in monitoring friendships.

Theory of Balance

Balance theory, which is based on pair orientations, states that similarity of attitudes, similarity of status, and similarity of location lead to a general integration of these factors which produces interpersonal attraction (Newcomb, 1961). Balance exists between two persons when their attitudes and status levels are consistent. In general, a "balanced state designates a situation in which the perceived units and the experienced sentiments coexist without stress; there is thus no pressure toward change, either in the cognitive organization or in the sentiment" (Heider, 1958). At college, for example, characteristics that are central in causing two persons to be considered a unit are similarity of spatial location (proximity) and similarity of class rank (peership).

University of Chicago study, which treated 25,000 pairs of students in an unusually extensive test of balance, offers a good example of typical balance theory (Priest and Sawyer, 1967). The study covered a four-year period so that changes in interpersonal attraction could be charted. The results showed that, as expected, class members were much more likely to have a close positive relationship with one another if they were close in proximity as well as in peership.

Role Relationship

Social interaction can also be thought of as a role relationship in that each participant shares with the other the activities of the roles he plays. The greater the degree of overlap in the roles of two participants, or the degree to which the participants share their roles, and conversely, identify with their friend's roles, the greater the likelihood of continued social interaction and the improvement of bonds. Those individuals who are able to share roles and who use social interaction as an opportunity for personal enrichment and self-expression are likely to be popular and have numerous social contacts. They also are able to enjoy a vicarious interest and to grow socially and emotionally through their acquaintances' life experiences and roles. Ideally, a wide group of occupations, including teachers, health and medical practitioners, and clergy and counselors, effectuates the goals of their practice by the sharing of roles. Frequently, however, participants are too busy meeting or exceeding the requirements of their roles to take time to share them.

Through role sharing, separate lives become more meaningful. Hard times provide perhaps the best situations in which role sharing can develop. Ease of identification is perhaps the principal factor. During the depression of the 1930's, people cherished most their self-esteem and their good friends. Similar friendship formation is evident with those who are dedicated to a cause, such as ghetto dwellers, handicapped students, or residents of a neighborhood living in an area designated for a freeway or an apartment complex. The more central role sharing is to the social relationship itself, the stronger the social bond becomes and the closer are the value orientations. Unlikely as it may seem, there are good reasons to suggest that value orientations and role sharing are influenced by distance as well. The strength of propinquity, as well as the juxtaposition of those within the same social network, such as co-workers, causes individuals who expect high levels of interaction to misperceive one another favorably and to engage in a greater amount of role sharing than would be otherwise expected. Athanasiou and Yoshioka (1973) note in the case of political beliefs that: "Subjects' perceptions of their friends' political beliefs were better able to discriminate (sic) between friends and non-friends than were actual political affiliation. It seems likely that the spatially closer the friend, the more an individual would tend to distort her perceptions in a direction which would be compatible with maintaining contact through propinquity." Apparently individuals are seeking cues to streamline the problematical process of friend selection. Distance, a surrogate for perceived social similarity, is a prime and easily used cue.

Costs and Rewards (Opportunity) Theory

Behavioral research has noted the costs to the individual associated with maintenance of social contacts over space (Thibaut and Kelley, 1959; Cox, 1968).

Social interaction requires effort and this effort or cost is compared and weighed against the actual or expected rewards or payoffs gained from interaction. Continuance of voluntary interaction depends upon mutual rewards experienced by participants. If the rewards appear to be greater than actual or anticipated costs, the acquaintance is likely to continue. Individuals frequently review these perceived rewards and costs to decide whether or not to continue future interaction or to make new contacts. The costs and rewards framework fits easily into what is known about space preference structures.

A social interaction-space preference structure is similar to an indifference curve in that an individual may be willing to trade-off extra costs of distance to reach a

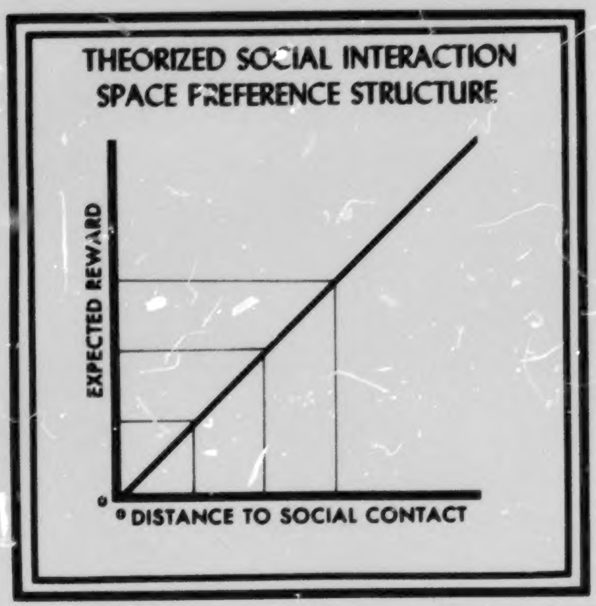

Figure 17. Individuals are willing to trade-off extra costs of distance to reach a social contact if the rewards at the destination are great enough. Individuals are indifferent to choice pairs along the heavy line.

social contact for greater rewards at the destination. The trade-off is viewed as being constant and linear (Figure 17). Actual selections of social contacts at a distance may well conform to a normal distribution about an indifference curve. Space preference structures using indifference curves have been revealed for travel in rural areas (Rushton, 1969a, 1971a). They are just now surfacing for social and recreational travel (Stutz and Butts, 1976; Stutz and Hinshaw, 1976).[6]

Individuals make subjective evaluations of the worth of their leisure time, and this can depend upon the availability and use of the leisure time. As leisure time becomes less available to the individual, opportunity costs may go up, resulting in less social travel. The individual's ability to use leisure time depends upon the range of alternatives available. The range of alternatives depends upon acquiring information about one's spatial system and upon the number and diversity of the roles one plays in a variety of social networks. As an individual undergoes a change in family life cycle, such as having children, the functional range of leisure time activities and the ability to use the leisure time changes. The individual may now substitute family activities for leisure time previously spent for other forms of social interaction.

Social interaction categories according to distance discussed earlier fit well into the opportunity model. Relatives, friends, and neighbors represent decreasing levels of social rewards, as long-standing research has shown (Figure 3). One can discount the likelihood that individuals experience equal payoffs from all social contacts or that they will travel whatever the necessary distance to each contact. This results from the relatively small number of neighbors remaining as social contacts after a residential relocation takes place. Trips to friends infrequently went to six miles, unlike trips to relatives that occur regularly at distances up to and beyond twenty miles. Apparently, individuals are willing to travel greater distances in order to gain greater rewards from interaction. This finding is one of the basic underpinnings of the opportunity model (Stutz, 1973b). Expected rewards must be great enough to offset the costs of travel. Longer trips indicate higher costs and, therefore, greater rewards must be gained. A descriptive model of nonwork travel utilizing the concepts of costs and rewards is given in Figure 18. The selection of a destination for a nonresidential social trip, such as going out to dinner, would fit into this decision process.

There have been at least two recent attempts at applying this model by measuring the suggested cost-and-reward behavioral trade-off function for noninterresidential social travel. The first deals with travel for the socioreligious experience and the second deals with social travel to ocean beaches. The first study involved an examination of travel to 14 Churches of Christ in the greater San Diego area (Stutz and Hinshaw, 1976). The questions of social travel behavior that were dealt with were: exactly how is distance substituted or traded-off against size of congregation (a surrogate for level of social opportunity) and how many extra members are required in order for an individual to be induced to travel an extra mile? The data used in this study were collected from membership directories and supplemented by actual questionnaires. Of the 1,417 households included in the directories, 42 percent were found to attend a congregation other than the one nearest their residence (Figure 19). The principle of least effort was found to be an important facet of travel to church but it clearly did not describe the entire decision process. A moderately strong relationship was found for the distance traveled to church as compared to church size. Similar to some shopping and recreation travel behavior, individuals are willing to travel an extra distance to large churches in the expectation of a greater social reward or payoff at the destination (Figure 20). Large congregations generally offer a broader range of participatory activities than do small congregations, such as bible study groups, various youth groups, athletic facilities, team competition, child care centers, counseling services, and a wide range of social contacts. These activities and opportunities are likely to attract a large number of members from many areas of the city, and insure that those church members who have moved away from the immediate area will retain their membership.

A second study attempted to apply a form of the opportunity model using a new approach from mathematical psychology known as information integration theory. An experiment was designed to isolate and scale environmental variables important in social travel to the beach and to develop a predictive model (Stutz and Butts, 1976). Based on questionnaire results, cleanliness

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[6] The elements involved in an individual's decision to make a social trip can be expressed in a variety of ways. Stutz (1973b) presents an opportunity model of the social travel decision process as one way of viewing the process. For details check this reference.

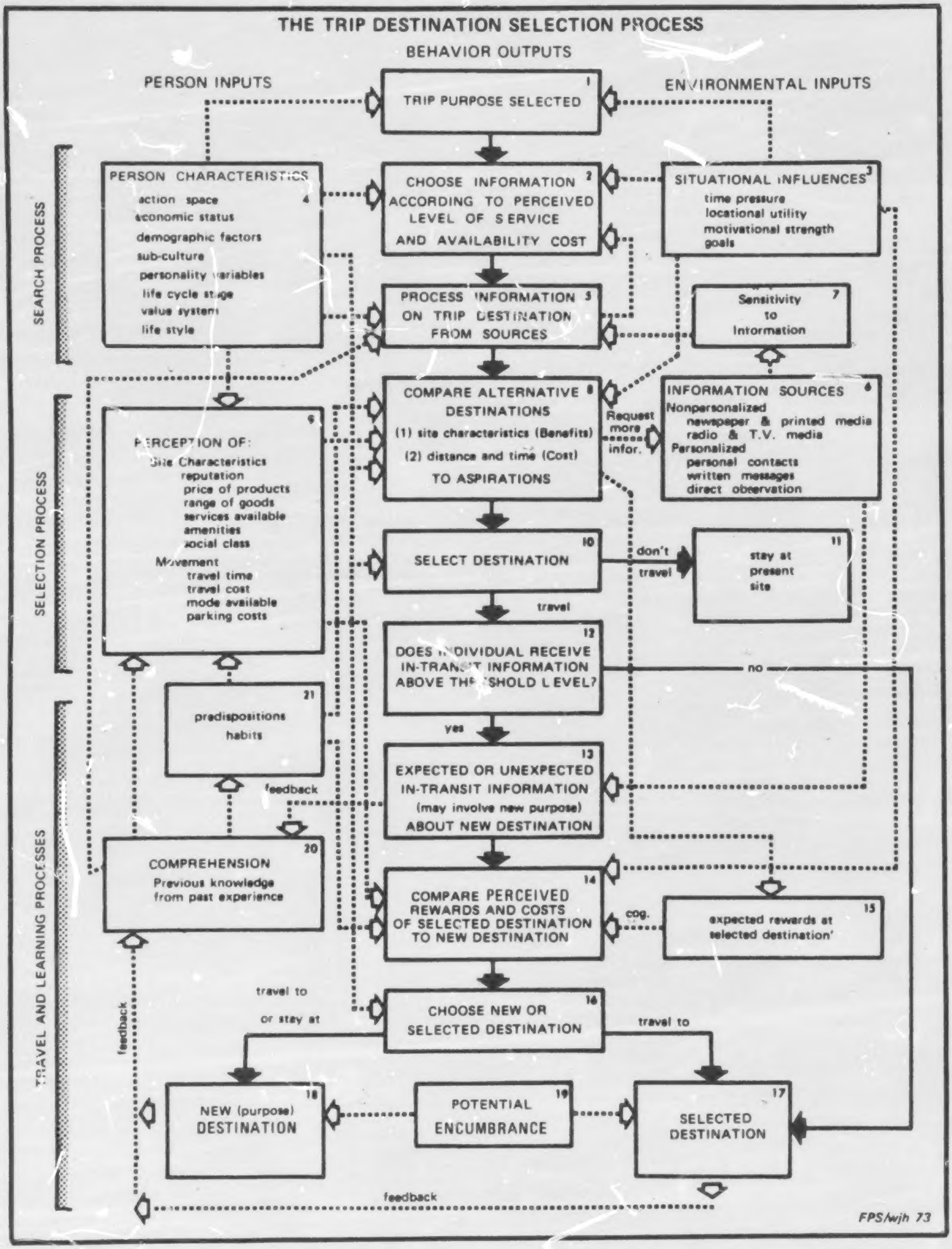
THE TRIP DESTINATION SELECTION PROCESS
BEHAVIOR OUTPUTS
PERSON INPUTS
ENVIRONMENTAL INPUTS
1 TRIP PURPOSE SELECTED
2 CHOOSE INFORMATION ACCORDING TO PERCEIVED LEVEL OF SERVICE AND AVAILABILITY COST
3 SITUATIONAL INFLUENCES time pressure locational utility motivational strength goals
4 PERSON CHARACTERISTICS action space economic status demographic factors sub-culture personality variables life cycle stage value system life style
5 PROCESS INFORMATION ON TRIP DESTINATION FROM SOURCES
7 Sensitivity to Information
6 INFORMATION SOURCES Nonpersonalized newspaper & printed media radio & T.V. media Personalized personal contacts written messages direct observation
8 COMPARE ALTERNATIVE DESTINATIONS (1) site characteristics (Benefits) (2) distance and time (Cost) TO ASPIRATIONS
Request more infor.
9 PERCEPTION OF: Site Characteristics reputation price of products range of goods services available amenities social class Movement travel time travel cost mode available parking costs
10 SELECT DESTINATION
don't travel
11 stay at present site
travel
12 DOES INDIVIDUAL RECEIVE IN-TRANSIT INFORMATION ABOVE THRESHOLD LEVEL?
no
yes
13 EXPECTED OR UNEXPECTED IN-TRANSIT INFORMATION (may involve new purpose) ABOUT NEW DESTINATION
21 predispositions habits
feedback
20 COMPREHENSION Previous knowledge from past experience
14 COMPARE PERCEIVED REWARDS AND COSTS OF SELECTED DESTINATION TO NEW DESTINATION
cog.
15 expected rewards at selected destination'
travel to or stay at
16 CHOOSE NEW OR SELECTED DESTINATION
travel to
18 NEW (purpose) DESTINATION
19 POTENTIAL ENCUMBRANCE
17 SELECTED DESTINATION
feedback
feedback
SEARCH PROCESS
SELECTION PROCESS
TRAVEL AND LEARNING PROCESSES
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Figure 18. Nonresidential social travel model (Stutz, 1977; courtesy of the Association of Pacific Coast Geographers, *Yearbook*).

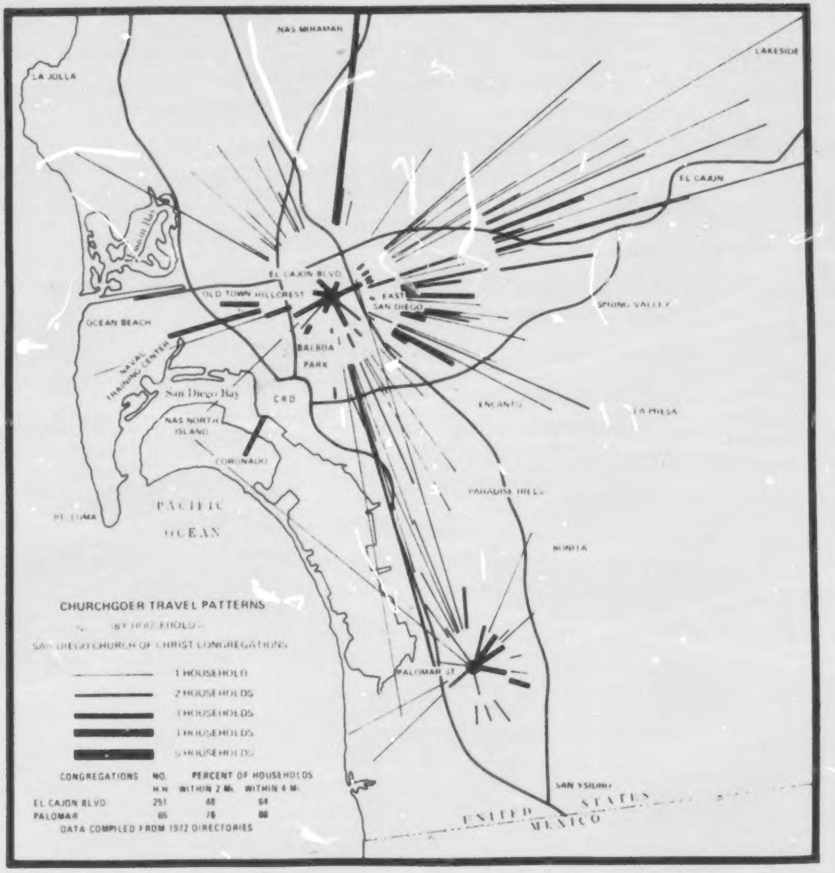

NAS MIRAMAR
LAKESIDE
LA JOLLA
EL CAJON
Mission Bay
EL CAJON BLVD
OLD TOWN HILLCREST
EAST SAN DIEGO
SPRING VALLEY
OCEAN BEACH
NAVAL TRAINING CENTER
BALBOA PARK
San Diego Bay
CBD
ENCANTO
LA MESA
NAS NORTH ISLAND
CORONADO
PARADISE HILLS
PT. LOMA
PACIFIC
OCEAN
BONITA
CHURCHGOER TRAVEL PATTERNS
(BY HOUSEHOLD)
SAN DIEGO CHURCH OF CHRIST CONGREGATIONS
1 HOUSEHOLD
2 HOUSEHOLDS
3 HOUSEHOLDS
4 HOUSEHOLDS
5 HOUSEHOLDS
CONGREGATIONS NO. H.H. PERCENT OF HOUSEHOLDS WITHIN 2 MI. WITHIN 4 MI.
EL CAJON BLVD 251 48 64
PALOMAR 65 78 88
DATA COMPILED FROM 1972 DIRECTORIES
PALOMAR ST
SAN YSIDRO
UNITED STATES
MEXICO

Figure 19. Sociospatial travel to two San Diego Church of Christ congregations as shown by graduated line segments. Distance is a constraining factor but there is some overlap for these two congregations: forty-two percent did not attend the nearest church. People substituted longer trips for greater participation opportunities at the church. The most preferred congregation was one with 200-300 members, located within two miles of the member's residence (Stutz and Hinshaw, 1976).

of the beach and crowding were selected as variables along with travel time.

The results show how individuals trade off attributes and yield the likelihood of beach selection based on various combinations of beach qualities (Table 10). The initial questionnaire survey indicated that distance was relatively unimportant, as it ranked eighth in frequency of occurrence. Experimental results, however, showed that distance was the most important of the three selected attributes. Distance and cleanliness were found to have, respectively, monotonically decreasing and increasing effects on the independent variable, probability of beach selection (Figure 21). The crowding variable resulted in a function that was convex to the origin and asymmetrical about the defined midpoint. This latter result indicated the possibility of a crowding threshold required to make a beach attractive. For example, San Diego has the only legal nude beach in the United States and it has proved to be extremely popular with college students. Subjects were trading off the relative importances of the three attributes without a realization of the process as shown by the results of the initial questionnaire. (For a more complete treatment of the technique used here, see Technical Note 2 at the end of this chapter.)

Conclusions and Policy Recommendations

Community social interaction is sometimes retarded for reasons of sheer territorial size and simple problems of identity. Natural features tend to create a sense of containment to communities. The existing residential character of communities can be enhanced by identifying, and then improving parks, streets, landmarks, and any other areas that have a sense of place or quaintness to them. Guidelines should be established for new developments which complement the size, height, setback, parking, landscaping, open space, and other community elements that give character to areas but which still allow variety and change.

Community entrances should be marked and named, similar to those in new towns across Europe. Commu-

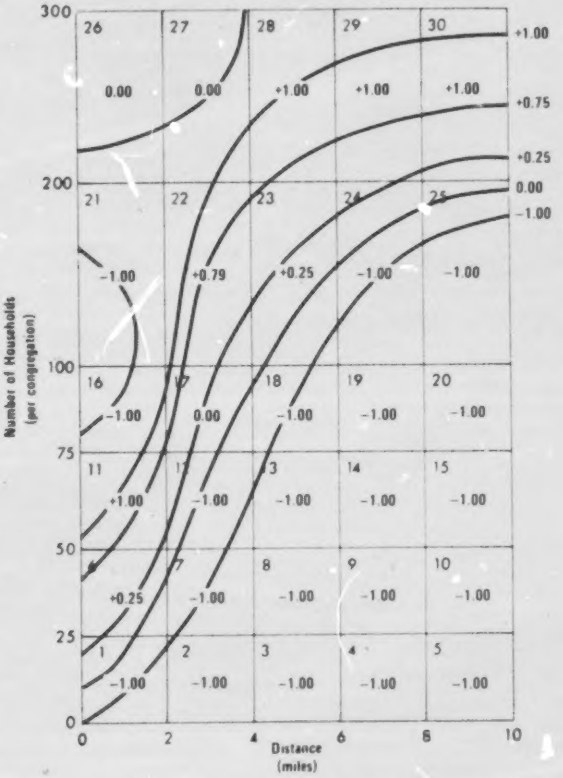


Figure 20. Sociospatial trade-off travel behavior showing selection of congregational size and distance for which individuals are indifferent. Each wavy line shows the combinations of congregation size (measured in number of households) and distance from home that individuals rate as approximately equal in terms of rewards and costs. Values on each line show the relative desirability of each set of combinations. Values in the upper corner of each box denote a locational type, e.g. churches of 25 households at up to two miles away are Type 1. Distance is more constraining for small congregations. Compare this figure with the theoretical structure in Figure 17. See Technical Note 1 at the end of this chapter for further discussion of this technique (Stutz and Hinshaw, 1976).

nities must be guarded from substantial through traffic. Earlier studies showed that high volumes of traffic on residential streets causes household introversion and makes families withdraw from the street and from the people who live along it. Automobiles and trucks can be noisy, dangerous to pedestrian safety, and polluting. There are inexpensive techniques of monitoring traffic volume and speed by such features as diagonal diverters that can be built at four-way intersections. These diverters do not allow through traffic but require motorists to make a right-angle turn. Experience shows that this feature reduces traffic to those origins and destinations on the street itself. Some grid-pattern streets could be made into cul-de-sacs. Alleys could be used for auto access. The capacity of the arterials may have to be increased to allow for the diverted flow of cars and trucks.

Arterial capacity can be increased by widening the pavement and by prohibiting parking along the curb. Better traffic signalling devices and general traffic control could be planned. Traffic pavements could be shifted off-center to yield a wider sidewalk on one side. The use of walkway overpasses and depressed streets can help raise the level of motorized traffic without greatly harming pedestrian use. Where an arterial street is the main shopping street for a community, it is better to divert traffic away from it. In some areas, such as Riverside, California, this has increased sales substantially. Planning by merchants' associations or community groups could create special street events on a regular basis, both for commercial activity on arterial streets and for social interaction on the local streets.

More space could be brought into use. Whole blocks could make and maintain their own miniparks for children to cultivate vegetables or to grow flowers (Figure 22). Such miniparks can be established with present, mandatory builder-dedicated open space funds which normally go for resource-based parks on the edge of the suburban area. Legal machinery to establish such parks presently exists as well as the techniques for establishing special assessment districts to pay the property taxes of the parcel used, principally by those nearby. The public

TABLE 10. TRAVEL DISTANCE AND DISPERSAL OF MEMBERS, 1972

Congregation	Dist. From CBD	Households		Travel Distance		No. of Households Within			
		No.	Rank	Avg.	Rank	2 Mi.	Rank	4 Mi.	Rank
National Ave.	2.50	25	13	5.67	14	36%	14	72%	11
Oceanview	3.50	61	10	1.52	1	66%	6	90%	3
Raven St.	3.75	56	12	2.74	10	68%	4.5	91%	2
El Cajon Blvd.	4.00	251	1	2.01	5.5	48%	9.5	64%	14
Linda Vista	4.50	64	9	1.75	3	69%	3	88%	5
Pacific Beach	5.00	118	5	2.60	9	48%	9.5	77%	8
L St. (4th Ave.)	7.25	139	3	2.56	8	54%	8	84%	7
Clairmont	7.75	80	6	1.62	2	75%	2	96%	1
Allied Gardens	7.75	76	7	3.09	12	45%	12	68%	12
Lemon Grove	8.25	127	4	3.01	11	40%	13	76%	9
Imperial Beach	9.00	59	11	1.87	4	68%	4.5	86%	6
Palomar	9.75	65	8	2.01	5.5	78%	1	89%	4
Le Mesa	10.25	215	2	3.36	13	47%	11	67%	13
Santee	13.50	20	14	2.33	7	60%	7	75%	10

Source: Stutz and Hinshaw, 1976.

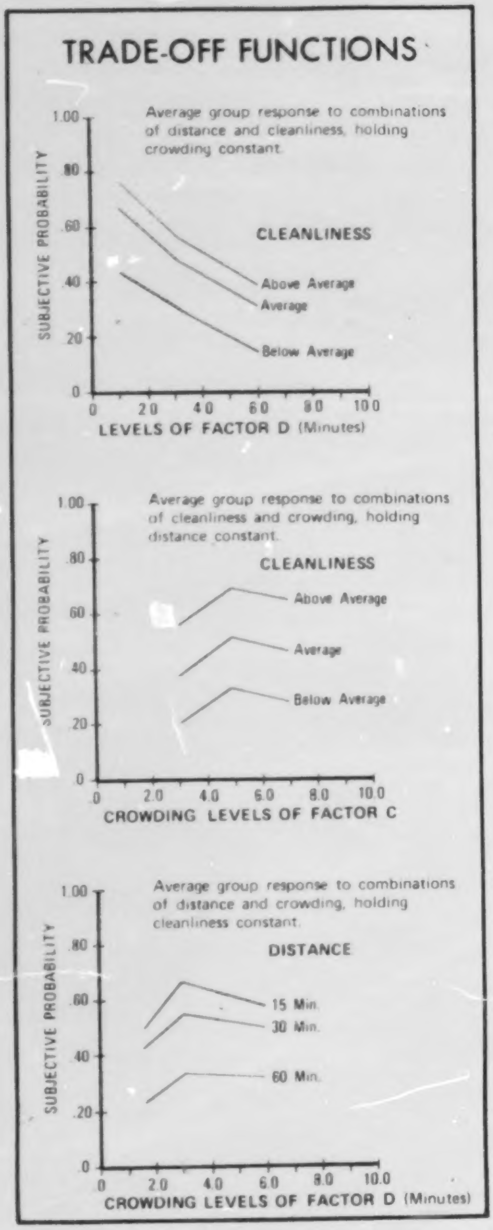


Figure 21. Combinations of distance and beach quality are reflected in the probability that a beach will be selected. See Technical Note 2 at the end of this chapter (Stutz and Butts, 1976).

establishment of such small spaces rarely occurs because of the legal procedures that must be completed. Special community sessions in which public officials meet with the residents and help work out such developmental plans must happen. Also, closing off some streets and reducing the speed limit on others can provide more opportunities for walking and will enhance social interaction. The community will be safer for children on their way to school.

When development occurs in small units and when there is a large mix of housing, employment, and services, a more interesting landscape can be created. The community will be more transportation-efficient as well. The trip to work and to shopping might be subsequently reduced, allowing the immobile, especially the elderly and handicapped, to get about without long trips for basic necessities. These solutions call for a reorganization of spatial structure of the whole urban area. It means a more flexible and detailed approach to zoning and other public rules, and suggests a greater reliance on planned unit development approaches and on performance standards. A limit could be placed on the maximum size of any contiguous development (Appleyard and Lynch, 1974).

Community Advocacy Planning

Decision making for land use planning has increased in visibility, especially in inner city communities. This has come principally from residents making greater demands about playing a role in the determination of critical issues affecting their landscape. This is important because these issues can have major consequences for the living fabric of communities, and because of the larger questions of social and ethnic organization, the right to participate in the community affairs and decision making, and problems of equity, power, and authority (Mumphrey *et al.*, 1971; Wolpert *et al.*, 1972). In order for low income neighborhoods to exercise greater control over their future, they must be able to exercise power in four principal areas. They must be able to maintain existing properties, eliminate undesirable land use activity, prevent "noxious" facilities from entering, and induce changes that are compatible with the community's overall objectives (Wolpert *et al.*, 1972).

In San Diego, the County agency granting annexations and incorporations of cities is currently using the interactance community technique (along with other devices) to determine territorial spheres of influence and the location of freeways. This agency is the Local Agency Formation Commission (LAFCO). It is a regulatory body responsible for discouraging urban sprawl and for encouraging the orderly formation and development of local governmental agencies based upon local conditions. The agency was created by state law and there is a LAFCO in each county in California. In meeting its responsibility, LAFCO is required "to review and approve or disapprove, with or without amendments, wholly, partially, or conditionally, proposals for": the incorporation of cities, the exclusion of territory from a city, the disincorporation of a city, and the consolidation of two or more cities. It can also form special districts, detachments, dissolutions, mergers, reorganizations, and consolidations

Factors to be considered in the review of a proposal include populations, population density, land area and land use per capita assessed valuation, topography, proximity to other populated areas, the likelihood of significant growth in the area, the need for organized community services, the present cost and adequacy of governmental services and controls in the area, and

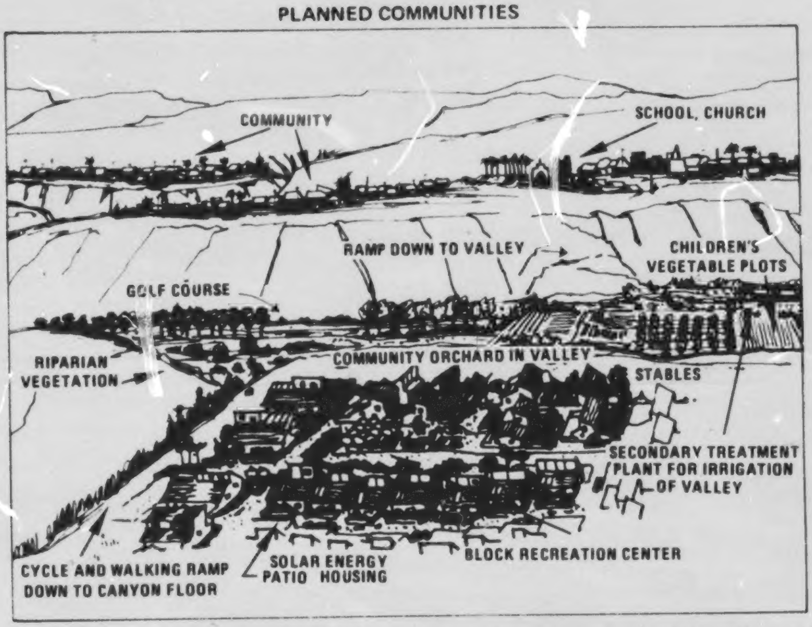

PLANNED COMMUNITIES
COMMUNITY
SCHOOL, CHURCH
RAMP DOWN TO VALLEY
CHILDREN'S VEGETABLE PLOTS
GOLF COURSE
RIPARIAN VEGETATION
COMMUNITY ORCHARD IN VALLEY
STABLES
SECONDARY TREATMENT PLANT FOR IRRIGATION OF VALLEY
BLOCK RECREATION CENTER
SOLAR ENERGY PATIO HOUSING
CYCLE AND WALKING RAMP DOWN TO CANYON FLOOR

Figure 22. A planned community. In order to enhance community interaction and stability, the community must be well-defined spatially by taking advantage of natural features. If the community provides such activities as recreation (golf courses, cycle and walking ramps, recreation center, vegetable garden plots) close by, total transportation can be reduced not only to make the community efficient, but also to help the transportation disadvantaged to reach activities closer to home. At the same time, harmful transportation impacts, especially air pollution, can be reduced.

probable effects of the proposed incorporation or annexation. Other factors include the effect of the proposed action on adjacent areas, and the "definiteness and certainty of the boundaries of the territory, the nonconformance of proposed boundaries with lines of assessment or ownership, the creation of islands or corridors of unincorporated territory, and other similar matters affecting the proposed boundaries." LAFCO is to consider the sphere of influence which may be applicable to the proposal being reviewed. Interactance community analysis is the basis of the spheres of influence studies (Figure 23). "A sphere of influence is a plan for the probable ultimate physical boundaries and service area of a local governmental agency, as determined by LAFCO." Factors the commission must consider in determining the sphere of influence in each governmental agency are: 1) "the maximum possible service area of the agency based upon present and possible service capabilities of the agency," and 2) "the existence of social and economic interdependence and interaction between the area within the boundaries of a local governmental agency, and the area which surrounds it and which could be considered within the agency's sphere of influence." Population projections and future land use models are used as data for a modified interactance community model.

There is a need to determine which communities in a metropolitan area are strong in the sense of cohesion and which are weak. An approach aimed at this need is examined in Chapter Four. The precise conditions which demonstrate the concept of a strong community are those which are basic necessities for the disadvantaged members of our society—the poor, the youth, the elderly, and the handicapped. The great mass of "average" people can afford conditions of low cohesion. They can afford to drive long distances for basic services. They can afford the relatively expensive municipal services. The disadvantaged cannot afford these luxuries. One question arises, then: "Is there greater community cohesion where there are more elderly, children, handicapped, and poor?" Chapter Three deals with the transportation problems of these groups.

TECHNICAL NOTE 1: SOCIORELIGIOUS SPATIAL BEHAVIOR USING MULTIDIMENSIONAL SCALING

The goal was to describe the spatial trade-off individuals make from data identifying spatial choices. The process of spatial trade-offs was viewed as one in which a set of opportunities was compared to a spatial behavior pattern and a choice made of those opportunities which were most attractive to an individual. Alternatives were defined in terms of combinations of distance separation and the place utility. As in earlier studies

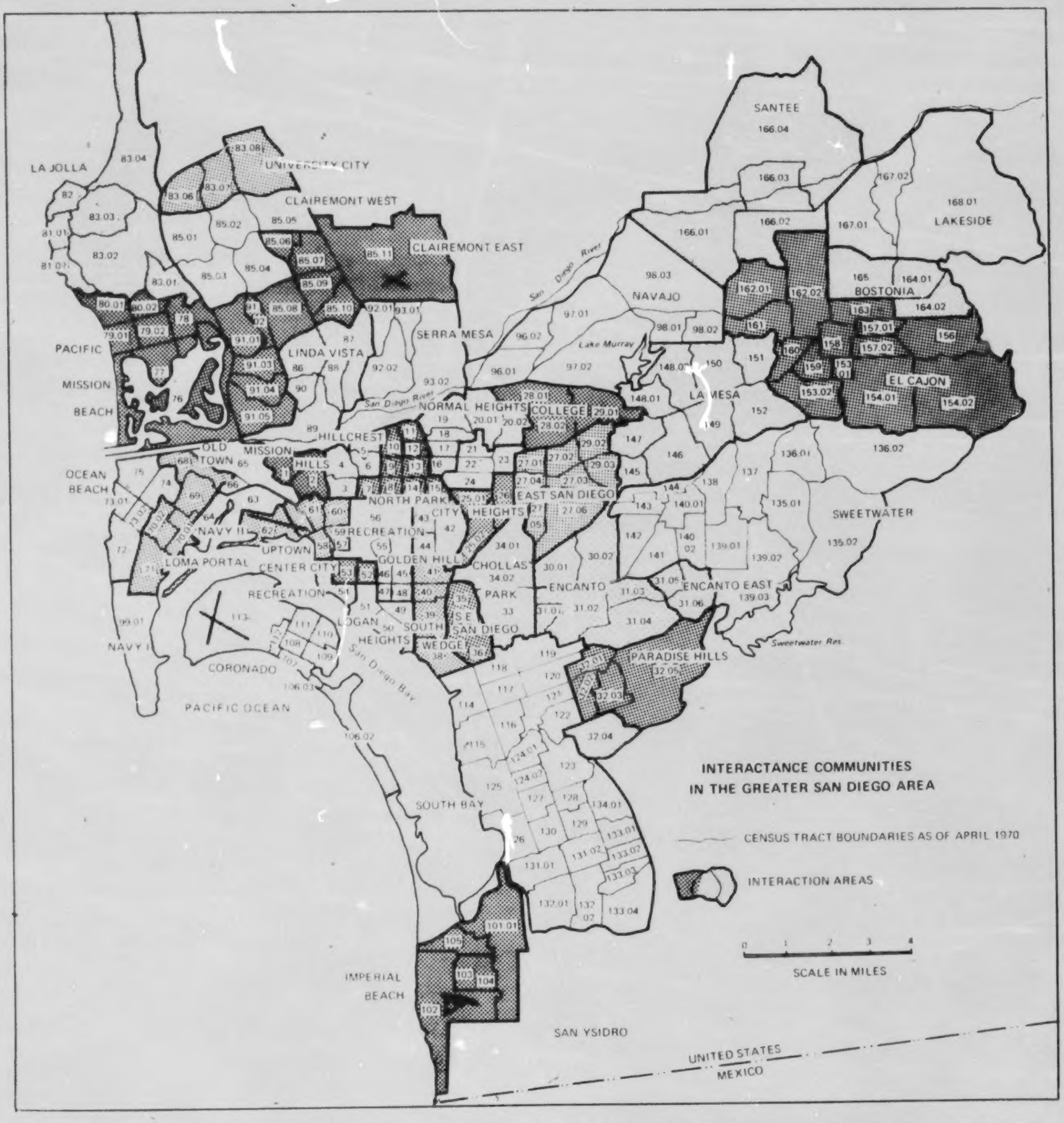

INTERACTANCE COMMUNITIES
IN THE GREATER SAN DIEGO AREA
CENSUS TRACT BOUNDARIES AS OF APRIL 1970
INTERACTION AREAS
0 1 2 3 4
SCALE IN MILES
LA JOLLA
UNIVERSITY CITY
CLAIREMONT WEST
CLAIREMONT EAST
SANTEE
LAKESIDE
BOSTONIA
NAVAJO
SERRA MESA
LINDA VISTA
PACIFIC
MISSION
BEACH
EL CAJON
LA MESA
NORMAL HEIGHTS
COLLEGE
HILLCREST
MISSION
HILLS
OLD
TOWN
OCEAN
BEACH
NORTH PARK
EAST SAN DIEGO
CITY HEIGHTS
NAVY II
RECREATION
UPTOWN
LOMA PORTAL
CENTER CITY
GOLDEN HILL
CHOLLAS
PARK
ENCANTO
ENCANTO EAST
SWEETWATER
RECREATION
LOGAN
HEIGHTS
SOUTH
WEDGE
S.E.
SAN DIEGO
PARADISE HILLS
NAVY I
CORONADO
PACIFIC OCEAN
San Diego Bay
San Diego River
Lake Murray
Sweetwater Res.
SOUTH BAY
IMPERIAL
BEACH
SAN YSIDRO
UNITED STATES
MEXICO

Figure 23. This map was produced for the San Diego County Local Agency Formation Commission by the author for the Commission's "Spheres of Influence" study. Presently Santee (northeast) and Sweetwater (southeast) are seeking incorporation from the county. By law, spheres of influence must be determined along with economic viability before a community will be allowed to incorporate. Interactance communities shown here are based on clustering all nonwork trips.

dealing with shopping behavior (Rushton, 1969b, 1971b), relative frequency with which one alternative was chosen over another, when both were present, was taken as an indication of how close, subjectively, the two alternatives were to one another. Data were generated to indicate which congregations were chosen, which were rejected, and the distances involved. Table 10 shows the average travel distances and size of each congregation in the study. All congregations within ten miles of each household were assigned to one of thirty locational types as defined in Figure 24. Table 11 lists the results of the number of possible and actual choices for each loca-

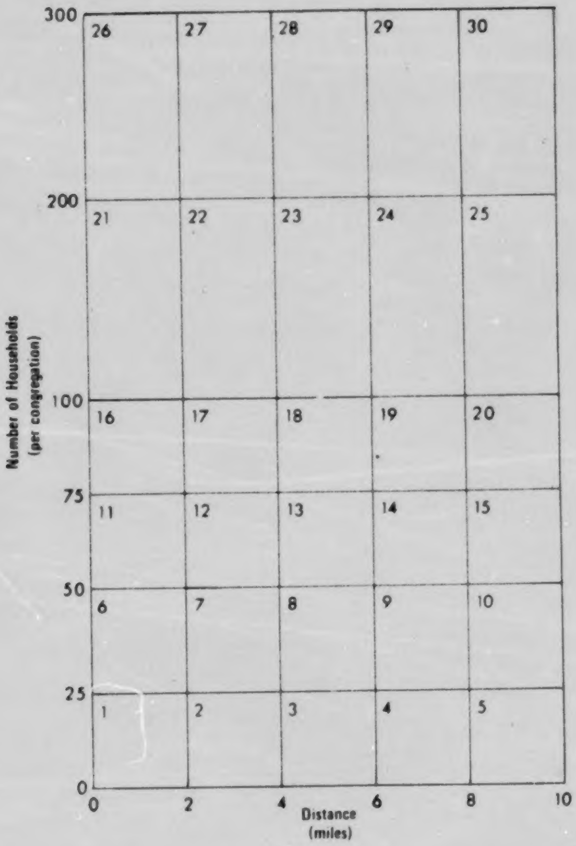


Figure 24. Socioreligious location types.

tional type. The indifference values listed in Table 11 are the percentages of households, from among those that could have selected each locational type, that actually did choose the locational type. The values have been plotted in Figure 25 and it is readily apparent that the most preferred congregation is one with 200-300 members, located within two miles of the member's residence. The study group appears to be indifferent about attending a congregation of 100-200 members, located less than two miles from their residence (Type 21), and a congregation of 200-300 members, located two to four miles from their residence (Type 27). To attract churchgoers from a distance of more than two miles, a congregation must have at least 75 members. As the congregational size (membership) increases, it is apparent from Figure 25 that persons are willing to travel longer distances. Only the largest congregations, in this case La Mesa and El Cajon Boulevard, attract households from a distance of six or more miles. As the indifference values show, distance is a constraining factor for the smaller congregations, but much less so for the larger ones.

The locational type of the congregation chosen by the household is considered preferred to all other locational types. The degree to which one congregation is preferred over another by households who can choose both is a measure of the similarity between them. The degree of choice can be computed as the proportion of times one congregation is chosen over the other when both are present. The probability that the *jth* locational type is preferred to the *ith* location type can be calculated as follows:

$$P_{jpi} = \frac{T_{ij}}{T_{ij} + T_{ji}}$$

where $T_{ij} = 0$, and $T_{ji} = 0$, P_{jpi} are undefined, and
$T_{ij} = 0$, and $T_{ji} > 0$, $P_{jpi} = 1$,
$T_{ij} = 0$, and $T_{ji} > 0$, $P_{jpi} = 0$ (Rushton, 1969b)

The maximum perceived similarity between any two types has a value of 0.5. A measure of the perceived similarity between locational types is given by,

$$d_{ij} = 1(P_{jpi} - 0.51)$$

The process used in evaluating the alternatives leads to a monotonically increasing function of interpoint distances in a matrix of similarities (d_{ij}). The REVPREV program accomplishes this process, and produces a table of scale values (Rushton, 1973). Table 12 lists the scale values computed for the choices made in selecting Church of Christ congregations in San Diego. Isopleths of these scale values have been plotted in Figure 20 (see

TABLE 11. LOCATIONAL TYPE VALUES

Location Type	Distance Group (miles)	Size Group (#HH)	Choices		Indifference Values
			Possible	Actual	
1	1- 2	0- 25	28	0	0.0
2	3- 4	0- 25	52	0	0.0
3	5- 6	0- 25	95	0	0.0
4	7- 8	0- 25	99	0	0.0
5	9-10	0- 25	114	0	0.0
6	1- 2	25- 50	225	75	33.3
7	3- 4	25- 50	298	0	0.0
8	5- 6	25- 50	470	0	0.0
9	7- 8	25- 50	411	0	0.0
10	9-10	25- 50	469	0	0.0
11	1- 2	50- 75	454	166	33.6
12	3- 4	50- 75	632	0	0.0
13	5- 6	50- 75	665	0	0.0
14	7- 8	50- 75	598	0	0.0
15	9-10	50- 75	733	0	0.0
16	1- 2	75-100	135	101	74.8
17	3- 4	75-100	249	5	2.0
18	5- 6	75-100	296	0	0.0
19	7- 8	75-100	312	0	0.0
20	9-10	75-100	347	0	0.0
21	1- 2	100-200	208	184	88.5
22	3- 4	100-200	365	53	14.5
23	5- 6	100-200	436	12	2.8
24	7- 8	100-200	375	0	0.0
25	9-10	100-200	363	0	0.0
26	1- 2	200-300	193	193	100.0
27	3- 4	200-300	259	227	87.6
28	5- 6	200-300	362	102	28.2
29	7- 8	200-300	343	95	27.7
30	9-10	200-300	362	17	4.7

Source: REVPREV program output from San Diego Church of Christ Membership Directories as tabulated by Stutz and Hinshaw, 1976.

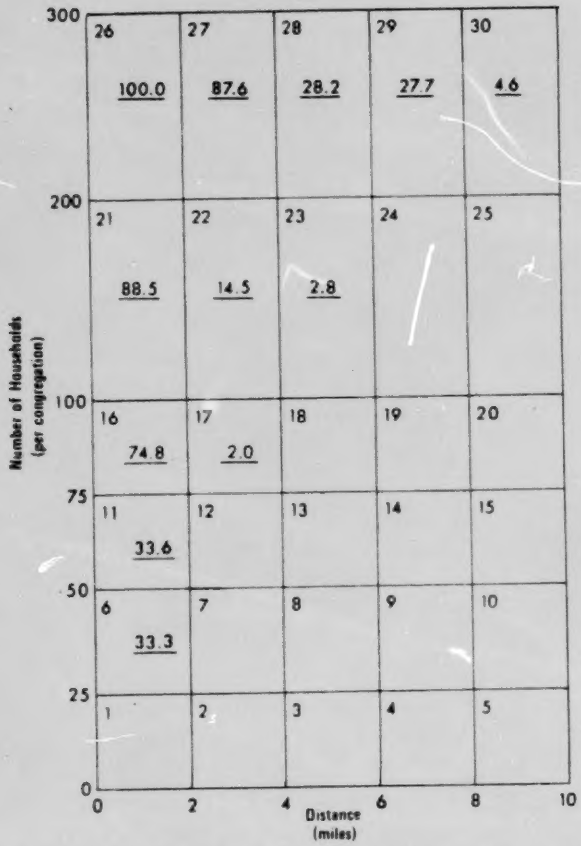


Figure 25. Indifference value distribution showing the percentage of households selecting a congregation with associated size and distance attributes (Stutz and Hinshaw, 1976).

Chapter Two). These lines are of equal scale value on the two variables, congregational size and distance, and represent an indifference surface of spatial trade-off behavior. The inference to be made is that the churchgoer would be indifferent between (i.e. receive equal satisfaction from) any two congregations along one of the isolines. Further, he would expect to receive the greatest satisfaction from the congregation lying on the highest point of the surface.

TABLE 12. RANKED LOCATIONAL TYPES

Rank	Locational Type	Scale Values	Percent > .5
1	27	0.00	96.55
2	29	+1.00	82.76
3	26	0.00	81.48
4	21	−1.00	80.77
5	28	+1.00	75.00
6	6	+ .25	69.57
7	16	−1.00	69.23
8	11	+1.00	64.29
9	22	+0.79	55.17
10	30	+1.00	44.83
11	23	+0.25	29.63
12	17	0.00	23.08
13	25	−1.00	0.00
14	25	−1.00	0.00
15	20	−1.00	0.00
16	19	−1.00	0.00
17	18	−1.00	0.00
18	15	−1.00	0.00
19	14	−1.00	0.00
20	13	−1.00	0.00
21	12	−1.00	0.00
22	10	−1.00	0.00
23	9	−1.00	0.00
24	8	−1.00	0.00
25	7	−1.00	0.00
26	5	−1.00	0.00
27	4	−1.00	0.00
28	3	−1.00	0.00
29	2	−1.00	0.00
30	1	−1.00	0.00

Source: Stutz and Hinshaw, 1976.

The shape of the isolines indicates the trade-off made between the attributes of congregational size and distance separation (residence to church location). Thus, vertical isolines indicate that the only attribute considered is that of distance separation, and as the isolines become more horizontal, the greater is the influence of congregational size. The trade-off behavior shown in Figure 20 (see Chapter Two) indicates that for the smaller congregations distance separation is a more important consideration for the churchgoer. The shape of the isolines seems to suggest a willingness to travel an extra mile to attend a larger congregation.

TECHNICAL NOTE 2: ENVIRONMENTAL TRADE-OFFS FOR TRAVEL TO BEACHES USING PSYCHOMETRIC SCALING

In developing information integration theory, Anderson (1962, 1973) has found that a response can be measured on the basis of both weight and scale values of a particular stimulus. Weight, as the term implies, is the degree of importance placed on a stimulus, either in a general or specific sense. Scale value denotes the position of a stimulus relative to all other stimuli on the same dimension. For a single stimulus or factor, this is expressed as

$$R = w_i s_i$$

where: R = the response measurement
w = weight value for cell i
s = scale value for cell i

One important constraint of this formulation is that of independence; the scale value and weight for each stimulus must be constant, regardless of other stimuli with which it may be combined. Reliance on Anderson's theories and methodology have great implications for travel behavior studies within the field of geography. They offer three main advantages over the alternative approaches: 1) goodness of fit tests are employed for both the response scale and the model, 2) a subjective scale of values can be derived for the independent variable (s), and 3) algebraic models are the framework for all aspects, including model estimation, goodness of fit, and scaling. General emphasis is placed on the development of theoretical models which represent the information integration process. The model is then hypothesized to fit the results of a particular experiment, tested for goodness of fit, and, if the test of fit is passed, it is used to scale the data. Some empirical work has been done in testing this theory in a variety of judgment situations such as perception of personal qualities, desirability of city-occupation combinations, preference for foods and drinks and their combinations, attitudes about U.S. presidents (Shateau and Anderson, 1969; Anderson, 1973), and in selecting among various modes of transit (Louviere, 1973a, 1973b). Except for this study, apparently Louviere's (1973a, 1973b) and Lieber's (1975) works are the only ones in geography to make use of this paradigm.

Results of the integration research tend to confirm the averaging process whereby the combination of favorable and unfavorable information elicits a response having some intermediate value. Similar effects are found when the difference in the elements of information is a matter of degree only, e.g. moderately favorable combined with highly favorable. A counter hypothesis of an additive process has been largely disproved. Both hypotheses are valid when the positive-negative combination is present. However, when the difference is in degree, the additive hypothesis would dictate a reinforcing effect. Empirical evidence supports the averaging hypothesis.

Based on questionnaire results for a random sample of college students in San Diego, cleanliness of the beach and crowding were selected as variables, along with travel time.[7] A 3^n factorial experimental design was used and results were analyzed with analysis of variance and multiple regression procedures. A factorial designed experiment was selected because it permitted both simultaneous evaluation of several variables with relatively few combinations, and it permitted an analysis of "within subjects" variation as well as "between subjects." The final design was a 3 × 3 × 10 × 20 factorial experiment using the two most frequently given attributes from the questionnaire results, beach and water cleanliness and beach crowding, as well as travel time as variables. These three attributes were used for each of three levels over two replications for twenty subjects. Descriptions of hypothetical beaches were developed by combining all variations of the three attributes with the three levels. Subjects indicated their subjective probability of selecting a beach by placing a mark at the appropriate point along a 100 millimeter line provided. Instructions were given to all subjects defining end anchors for scale extremes. These end anchors were stimuli combinations that served as reference points between which the subjects could gauge their own responses. Analysis of variance was used to establish the significance of the response data and, from this, the predictive model was developed (Stutz and Butts, 1976).

A summary of the analysis of variance results revealed that 18 of the twenty subjects, and the group as a whole, exhibited significant variation compared to the mean on all three main effects of distance (D), cleanliness (C), and crowding (P). Only four individuals showed significance to all combined effects. These results provided two insights as to the overall importance and relationship of the experiment variables. First, significance of the main effects indicated that consideration of the various levels of the three attributes would provide better predictive results than could be obtained from the grand mean of all responses. Second, the general lack of significance in the combined effects indicated independence of the attributes and linearity of the response measure.

Group average responses to distance and cleanliness with respect to the probability of beach selection exhibited monotonically decreasing and increasing relationships, respectively. Cleanliness responses were also equally spaced in accordance with the instructions. The crowding responses curve was convex with respect to the origin. Subjects appeared to have defined a beach average in crowdedness as their most desirable alternative. Sensitivity to reduced crowding was greater than to increased crowd levels. Examination of all two-way combined effects revealed parallelism of all factors, confirming the independence of the variables (Figure 21 in Chapter Two). The most probable response by the sample for any given combination of experimental variables is given in Table 13. The results suggested that a predictive model relating the stimulus (experimental variables) to the response (subjective probability of selection) would be linear (Figure 21 in Chapter Two). Group data were fitted to this model using a step-wise multiple regression analysis with the final result being

$$R_{ijk} = 4.709 - 0.769D_i + 7.071C_j + 6.901P_k$$

where: R_{ijk} = response (subjective probability)
D_i = distance in travel time
C_j = level of cleanliness
P_k = level of crowding

---

[7] The questionnaire used an open-ended question that asked: what factors or characteristics of a beach do you consider important in nonresidential social travel? Various items of personal data were also obtained. The first step was to generalize responses into distance categories. A frequency distribution was established to determine the prevalence of all categories, the assumption being that frequency of occurrence was a surrogate for the degree of importance. Analysis of potential bias introduced by the sampling was accomplished by means of contingency tables and chi-squared tests. An examination of the responses to the initial questionnaire revealed 13 general categories of beach attributes. These categories were areal aesthetics, water quality, crowds present, type of people present, surf qualities, travel time, quietness and remoteness, other facilities available, parking accessibility, beach size, cost of admission, beach cleanliness, safety, and special activities permitted. Eighty-eight subjects provided a total of 293 responses, of which 23 percent were beach cleanliness and 21 percent were crowd intensity. Parking accessibility, the third ranked variable, represented less than nine percent of total responses. Contingency tables of personal characteristics versus response variables indicated that there were no significant differences between subjects. The only personal factor indicating significance was frequency of beach attendance (x^2 = 70.603 with 44 degrees of freedom). From this it was concluded that elaborate sampling procedures were unnecessary.

TABLE 13. SELECTION PROBABILITIES FOR COMBINATIONS OF BEACH ATTRIBUTES*

	Distance								
	15 minutes			30 minutes			60 minutes		
	Cleanliness			Cleanliness			Cleanliness		
	–	Avg.	+	–	Avg.	+	–	Avg.	+
–	0.40	0.54	0.67	0.28	0.42	0.55	0.04	0.10	0.23
Crowding Avg.	0.53	0.67	0.80	0.41	0.55	0.69	0.09	0.23	0.37
+	0.49	0.63	0.76	0.37	0.51	0.64	0.05	0.19	0.32

* For an explanation of the technique yielding these probabilities, see Technical Note 2 at the end of this chapter.
Source: Stutz and Butts, 1976.

K = a constant
e = the random error in the estimate
i, j, k = weights of the respective variables

All of the coefficients were significant at the 0.05 level (t = 15.44, 12.08 and 5.79, respectively). The multiple correlation coefficient ($r = 0.94$) was also significant at the 0.55 level ($F_{3,23} = 139.41$). Beta coefficients for the three variables—distance, cleanliness, and crowding—were 0.735, 0.575 and 0.276, respectively.

III. TRANSPORTATION FOR THE DISADVANTAGED

Although the failure of the planned community concept can attenuate social ties, as was described in the last chapter, it can also present major problems of transportation for the immobile who must go long distances for basic services. This chapter will deal with the treatment of four principal groups: the poor, the youth, the handicapped, and the elderly. There are significant overlaps among these groups, but in general, they represent the margins of transportation use and service in the United States (Figure 26). It is difficult to assess the exact number of people who are handicapped; accurate census records are not kept on this group as they are for other groups whose distinctions are merely a matter of age or income. Unlike the wealth of definitions in the law for the term "elderly," existing legal descriptions of the handicapped are limited to employment capabilities of persons between the ages of 16 and 64. For example, the Federal Disability Insurance Statistics describe a qualified person as one who is unable to engage in any substantial, gainful activity. The United States Department of Labor establishes poverty levels according to income for families of various sizes. Youth are generally considered to be those below age 18. There are significant overlaps, unfortunately, within these disadvantaged groups. The largest of these overlaps is, perhaps, the elderly handicapped, followed closely by elderly poor (Figure 26). Not shown, however, are the elderly who are both poor and handicapped. Their number is sizeable, as is the number of children of poor families. Children who are mentally retarded and who have other congenital handicaps are also shown. These children stand a one-in-nine chance of being poor as well.

Society is just now beginning to deal with the serious problem of providing transportation for these disadvantaged people. For example, in our highly mobile society, with decentralized employment centers, the poor frequently have been left without access to jobs they need to survive. Problems of loneliness have assumed increasingly serious proportions for the elderly. Social, recreational, educational, and work opportunities are lacking for the youth and handicapped. The elderly and the poor suffer most.

The transportation problems of the disadvantaged lead to reduced action spaces for each group (Figure 27). These action spaces include the major activity centers in the city, along with the number and diversity of roles each person plays. Youths' action spaces extend as far as necessary for them to engage in activities they think are most important, principally social and recreational activities, without making it too expensive to return home. Except for the work trip, the major activities of low income families likewise tend to be clustered because of lower mobility rates from lack of car ownership or the confinement of the ghetto. Many youths maintain their restricted action spaces, as they are members of poor families. The majority, however, enlarge their action spaces as they mature. Roles and communication networks increase, and with time and access to mobility, boundaries of action spaces increase. As one reaches old age, occupational relationships are severed and mundane, bodily requirements assume a high priority, thus restricting boundaries to smaller movement territories. Many of the poor progress to old age without ever attaining the greater mobility of the middle-aged majority. For the elderly, the greatest proportion of trips are for personal business and shopping; nonessential travel is substantially reduced. For the handicapped, the action space is likely to be even more restricted than for the elderly, and is formed along narrow corridors even though the frequency of travel is greater than it is for the elderly. The travel characteristics of each of these groups will be examined below.

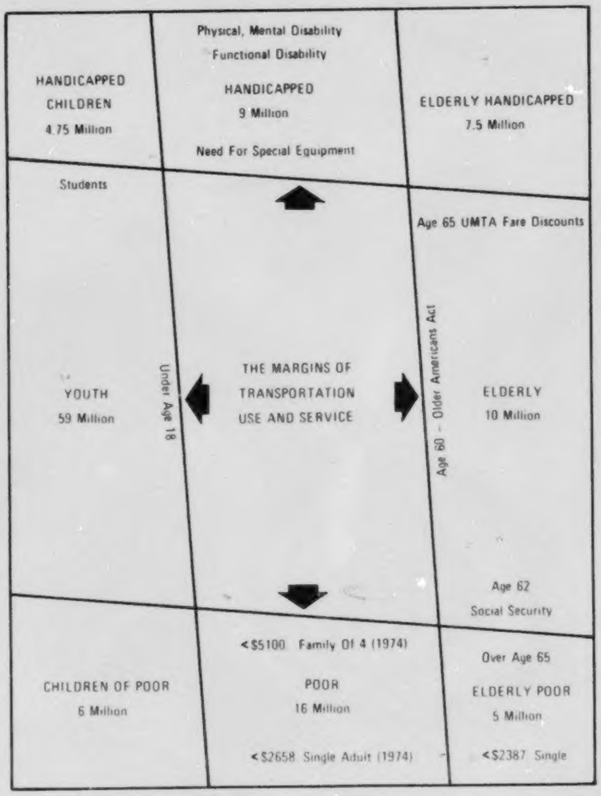

HANDICAPPED CHILDREN
4.75 Million
Physical, Mental Disability
Functional Disability
HANDICAPPED
9 Million
Need For Special Equipment
ELDERLY HANDICAPPED
7.5 Million
Students
YOUTH
59 Million
Under Age 18
THE MARGINS OF TRANSPORTATION USE AND SERVICE
Age 65 UMTA Fare Discounts
Age 60 – Older Americans Act
ELDERLY
10 Million
Age 62
Social Security
CHILDREN OF POOR
6 Million
<$5100 Family Of 4 (1974)
POOR
16 Million
<$2658 Single Adult (1974)
Over Age 65
ELDERLY POOR
5 Million
<$2387 Single

Figure 26. The margins of transportation use and service are represented by the handicapped, the elderly, the poor, and the youth. There are significant overlaps among each group.

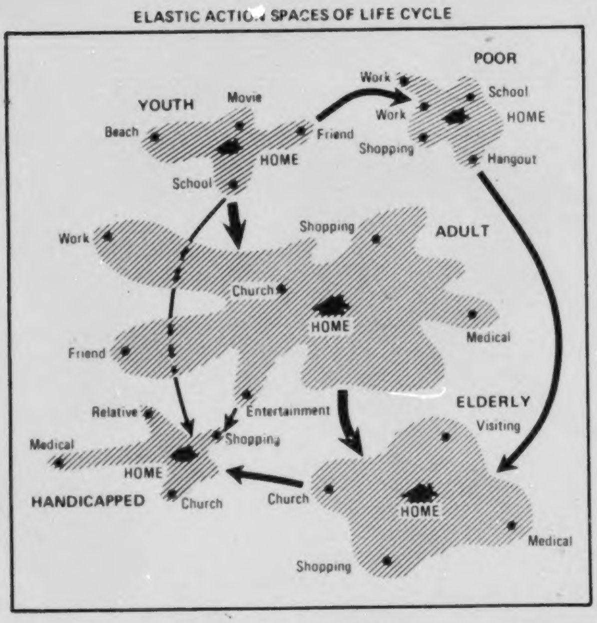


Figure 27. Elastic action spaces of the life cycle expand and contract as a function of age and physical condition. Graduated line segments show the proportions of people progressing to each group.

These transportation problems vary between urban and rural areas, and among regions of the country. There is a whole range of variations in urban communities. For example, some are older, high density communities with street corner services and medical facilities well served by public transportation. Others are new suburban communities with no public transit. In all of these communities, unmet transportation needs can assume major dimensions. Because of the complex nature of the multiple problems and general lack of an ability or opportunity for the disadvantaged to voice an opinion concerning their problems, communities have largely overlooked these special transportation needs. If our objective is to ensure everyone, including the disadvantaged, productive and balanced lives, special transportation needs must get immediate attention. That this objective is official policy, even if it has not been implemented to any great degree as yet, was spelled out for the elderly and handicapped in the Urban Mass Transportation Assistance Act of 1970 which stated:

> It is hereby declared to be the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services, that special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize will be assured; and that all Federal programs offering assistance in the field of mass transportation (including the programs under this act) should contain provisions implementing this policy.

Transportation Problems of the Poor and the Young

The recent energy crisis heightened the problem of transportation for the disadvantaged. The cost of mobility has risen at every level, except for cycling and walking, but these modes are not alternatives for the disadvantaged. For the poor, work places are often too distant to walk or cycle, and for most of the country cycling is not practiced throughout much of the year. For the elderly and handicapped these modes of transportation can be difficult at best.

The Poor

In 1976, a family of four with income under $5,500 was considered to be poor. Additionally, a single individual with income below $2,870 was in the poverty class. Approximately 14 percent of the population of the United States is at or below the poverty level. Transportation needs which are not met can severely affect this group. For example, the poor have a low automobile ownership rate, and increasing public transit fares tend to hit this group the hardest.

Lassow's (1968) study of fare increases in New York showed that the elasticity of demand was greater for buses, which suffered a ten percent reduction in ridership with a 25 percent fare increase, than it was for the subway, which suffered only a 2.5 percent loss with an equal fare increase. The disadvantaged groups, especially the poor, were hit hardest, particularly for discretionary (nonwork) trips. During weekend days and off-peak hours, ridership decreased more than during the peak hours. These off-peak times are precisely when shopping, recreation, and social visiting most frequently occur. Peak hour travel is primarily for work and school activities, but with a rise in fares, and a decline in ridership, level of service is also reduced. It is reduced most on weekday off-peak hours and on the weekend days. Again, the disadvantaged are the most severely affected because these periods are essential for trips related to life sustaining and maintaining functions. The Bay Area Rapid Transit in San Francisco, with its immense cost, is an example of poor service in off-peak hours, with no service after 8 p.m. from downtown, at least in early 1975.

Even travel to work can be affected for the poor. Recently several studies have attempted to link lack of transportation with unemployment levels. Ornati (1969:3) mentioned such a link in his study of New York City's poverty areas: "Policies aimed at reducing employment-related poverty must respond to the self-evident fact that travel inconvenience is a barrier to employment. The extent of this barrier is not known. Nor has any estimate been made of the degree to which increasing the convenience of travel can reduce the employment-related poverty." Industrial workplaces which were formally tied to the waterfront or to railroad properties have gradually shifted to the suburbs. (For a full discussion of these shifts, see Muller, 1976a.) This has left urban laborers, especially the blacks of the ghetto, with a serious deficiency in work places (Deskins, 1970).

Although job production in the inner cities has kept up with demand, the problem has been job access, especially to poor and blacks. Even for work places within the city limits, blacks spend more time commuting than other groups, partly because of the reliance on mass transit with its associated waiting and walking times (Kain, 1968).

Reverse commuting (from the city to the suburbs) for the poor is time-consuming and not particularly pleasurable. Collura and Schuster (1971) have documented the problem by tracing a ghetto dweller to a job in suburban Philadelphia. First is a trip downtown to a transfer point, then a transfer to a train moving against the predominant flow of traffic. There is often another transfer to a bus route that may not be synchronized with the train schedule. At the same time the more affluent traveler in an automobile can enjoy door-to-door service in comfort and convenience. Falcocchio *et al.* (1972) studied the nonwork travel characteristics (shopping, medical, recreational, etc.) of model cities residents in Brooklyn, New York, and found that the requirements and preferences are much the same as they are for the remainder of the population. However, most of the poor did not own automobiles and they were victims of the local mass transit. Several specific findings of this study are worth noting. They found that the poor of this model cities area 1) travel less because of economic constraints, with extra charges for additional zones being a particular burden, 2) rely almost entirely on public transit, 3) make longer shopping, medical, and recreation journeys than other residents in the city on the average, and 4) have a substantially reduced choice of where to travel for most nonwork activities.

Further work in Brooklyn, this time looking at the ghetto itself, gives additional information on the mobility plight of the poor, especially ghetto dwellers. Bernstein (1973) shows that residents do not see an improvement in local bus service as necessary for the work trip nor was this a step toward upward social and economic mobility. The relatively low ridership to the suburbs can be attributed to the lack of information flow to the ghetto concerning the job market. Businessmen looking for employees saw no need to make a special appeal to these residents. The restricted mobility of the urban blacks was most severely felt in the area of social travel. The major irony of the ghetto transportation problem is that the ghetto itself is frequently located near the most accessible location in the entire city, yet its residents are some of the most immobile of the city.

Lansing, Michigan, a medium-sized city, is a case in point, with its ghetto located near the center of town (Figure 28). The circles show points of equal accessibility as a percentage of the point of highest accessibility, the central business district. And yet, the actual travel patterns of the residents of the ghetto do not reflect this centrality (Figure 29). The social trip patterns of blacks in Lansing, as well as travel for other purposes, show a strong cluster effect. There is an extremely low level of connections with other parts of the metropolitan area. However, the ghetto itself shows strong cohesion and a strong internal linkage. It is possible to define the ghetto in cities not only on the basis of socioeconomic and ethnic characteristics of the population, or its bounded geographic location, but also on the basis of interaction alone. For example, the ghetto in Lansing as well as the one in San Diego (Logan Heights) comprise strong interactance communities themselves. These ghettos receive internalized movement and thus are perhaps the strongest communities in the sense of common origins and destinations.

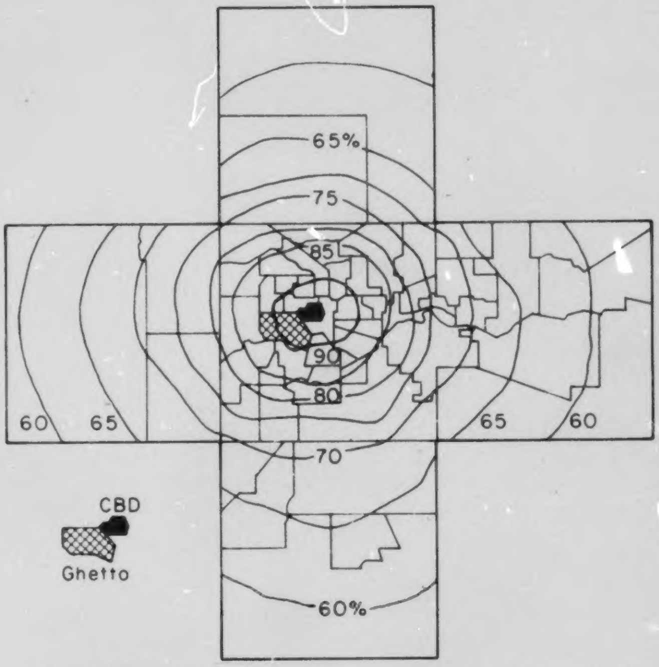


Figure 28. Levels of driving time accessibility are centered on the central business district in Lansing, Michigan. The black ghetto is adjacent to downtown but does not reflect this centrality in its travel patterns (Adapted from Wheeler, 1974: 58).

Physical barriers also demarcate the ghetto and these frequently take the form of heavily traveled streets or industrial land uses. But perhaps the strongest barrier is that of social distance or the degree of perceived dissimilarity between the ghetto dweller and those of the adjacent neighborhoods. A sense of territoriality and group identification, even in the midst of major economic differences within the ghetto, is one of the factors causing internalized interaction as well. The physical and social barriers about the ghetto enhance a sense of racial and territorial identification (Wheeler, 1971). The travel that does go outside the ghetto centers on certain downtown stores, restaurants, job locations, sporting events, or entertainment establishments that cater to blacks. The result is a restricted use of the city space (Figure 29). To produce this diagram, ghetto dwellers were asked to check off from a list areas in Lansing where they traveled regularly. The result is a substantially smaller part of the city than is frequented by suburban dwellers. Gould and White (1974) also note that the action spaces of ghetto dwellers tend to be

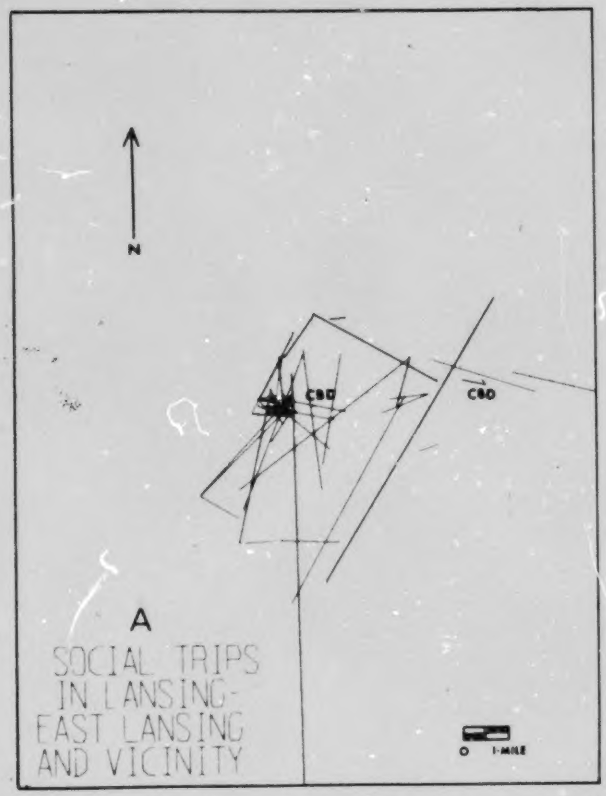


Figure 29. Social trips made by residents of the ghetto and other blacks in Lansing, Michigan, are shown to be tightly clustered. This computer-generated map was constructed from Lansing origin-destination data.

localized because of their restricted mental maps that result from dependence upon public transit and low mobility. These mental maps reflect the degree to which the blacks make use of the entire range of places and services in the urban area. The action spaces of blacks will continue to suffer great restrictions if the small amounts of information which penetrate the ghetto barriers continue at their presently weak rates.

The black ghetto dwellers of the inner city constitute less than half of the inner-city poor. The nonghetto urban poor are perhaps even harder to deal with because their residential areas are less than those of the ghetto dwellers. At least transportation programs that would serve the ghetto can be directed at a concentrated target. Morrill and Wohlenberg (1971) identify the locational patterns of the nonghetto poor as being largely in the inner city but also residing in small outlying suburban clusters. Herr and Fleisher (1968) report that the travel behavior of these poor is different in that they, by necessity, tend to compensate for lower mobility by reducing the nonessential recreation and social trips that they might normally make. In this Boston study their residences were strongly tied to work places, thus their work trips were also heavily reduced. These findings have also been documented for New York (Ornati, 1969), as well as for Indianapolis (Davies and Albaum, 1972).

There have been a number of trial programs at linking low income ghetto areas with suburban employment areas. These have ranged in expense from $500,000 in Buffalo to $2,700,000 in Los Angeles. One result showed that the dilemma was not so much a mobility problem as it was a problem of the workers' lack of job skills (Floyd, 1968). Reporting on the $1,159,000 demonstration program in St. Louis, Goering and Kalachek (1973) suggest several reasons for the failure of the reverse commuting program that took ghetto residents to suburban work locations. Suburban salaries were not appreciably better than those in the inner city, and the blacks were unhappy with the long journeys. Antipoverty agencies were basically nonsupportive of workers traveling to the suburbs because they felt that locally based neighborhood organizations ought to help the residents get the existing jobs in the inner city, which were apparently sufficient to meet the demand. The commuting vehicles themselves were also listed as a problem because of the large size and inflexibility. The study concluded with recommendations for door-to-door dial-a-ride, or other types of demand responsive systems.

The Young

Youth are a relatively overlooked part of the transportation disadvantaged, as most mobility studies have concentrated on the journey-to-work for adults. Generally the most disadvantaged part of this population is under 18, because most states do not grant drivers licenses until age 16 and automobile ownership in the 16–18 age category is restricted. Vehicular social travel has been shown in Chapter Two to be lower for the young than for other age groups in the population (Figure 5). Trip frequency for the young is lower for most other purposes as well. In a study in New York State, total trips per person per day for youth were from one-half to one-third that of trips made by individuals between the ages of twenty and 64, with low rates of auto ownership playing a significant role (Table 14). When one car was available, the daily rate doubled. Although data are sketchy, the problem is most severe in rural areas and in poor, urban neighborhoods.

Of any population age group, youth are probably the most resourceful in supplementing their transportation needs. If automobile transportation is not available, youth can walk longer distances to public transit stops, ride bicycles, and even hitchhike, not to mention the recent craze of skate boarding. Elderly and handicapped do not have these alternatives. But most of these alternatives have associated problems, especially in inner city areas and on heavily traveled streets. Although suburban youth have more playing space, they probably have less entertainment opportunities within their travel space. Again, the community is partly at fault. The lack of properly planned communities with a full range of services close at hand presents a problem. Shopping centers are frequently located at the junction of freeways and are accessible only by automobile (Muller, 1976a:41). Schools, once the building-blocks of the community, are frequently no longer within walking distance. Entertainment is the primary leisure time activity (Table 15), but

TABLE 14. ROCHESTER YOUTH TRIP RATES

	Zero Car			One Car		
Purpose	<$3,000	$3–8,000	>$8,000	<$3,000	$3–8,000	>$8,000
Walk	.02	.02	.03	.03	.02	.03
Shop	.03	.02	.06	.09	.07	.06
Social-Recreation	.15	.16	.11	.29	.17	.21
Personal Business	.02	.06	.03	.13	.07	.09
Eat Meal	.00	.01	.00	.00	.02	.03
School	.02	.10	.06	.18	.15	.14
Total	.24	.37	.29	.72	.50	.56

Source: Yukubousky and Politano, 1974: 50.

it is frequently even more remote than other activities. The dream of suburban youths is to "come of age" and attain car ownership to remove these obstacles. This may lead to ownership of vehicles in poor condition, with possible danger to themselves and their friends (*Manpower Report to the President*, 1971). But if they do not drive their own cars, they may ride the bus. Because of this, vandalism has risen at transit stations and inside the buses themselves. The microenvironment of the bus and the long ride early in the morning can have a negative psychological effect with its associated noise, unsightliness, and the antisocial behavior of other passengers.

The areas of the city frequented by youth are often underused because of youth's lower mobility levels. In San Diego, Appleyard and Lynch (1974) asked high school students to name the areas that they visited at least once a month (Figure 31). The mapped area shown corresponds roughly to the San Diego urbanized area with its 1.2 million residents (not including Tijuana). The high school students in La Jolla appear to spend their leisure time along the shore. Surfing is a favorite pastime, and they know every inlet. For the most part they do not own automobiles yet, and find it difficult to use the bus system that goes principally downtown from La Jolla. These youths rarely go south of downtown or east of Balboa Park. The inner city youth, on the other hand, spend their time near downtown and go as far north as Mission Valley (Figure 30). Their closest beach is at Coronado, but few of them ever use it because of bridge tolls and park entry fees. There is little overlap in action spaces between these two groups, even though their high schools are only eight miles apart.

Even at the college level, youth have mobility problems, especially if the school is in a small college town with little accessibility. Some schools, such as M.I.T., U.C.L.A., and the University of Maryland, have attempted to organize bus systems through student cooperatives. One innovative bus system, recently operated by an advertising professor at San Diego State, was funded entirely by advertising sales from signs on the interior and exterior of the buses. San Diego State University, with 33,000 students, most of whom are commuters, has a severe parking problem. The "bug line" as it was called, operated the "peanut butter briney weevil," and other buses from the heavily student populated beach areas to the university, providing not only free transportation, but also parking space relief. Each bus was customized on the exterior to match the bug line characters. The experiment proved to be a great success for two years, after which time it was sold to a student group, presumably for an expansion of service. It ran into management problems and soon died out.

Michigan State University has a well-developed bus system operating on campus in East Lansing. Because of the student body size, approximately 44,000, the physical separation of buildings, and the inclement winter weather, this system is a near necessity. For those students without automobiles, trips constitute movement in and around campus on weekdays, and back home on weekends to visit family (Figure 32). There is very little mobility between these two extremes.

TABLE 15. ROCHESTER YOUTH TRIP RATES PERCENT DISTRIBUTION

	Zero Car			One Car		
Purpose	<$3,000	$3–8,000	>$8,000	<$3,000	$3–8,000	>$8,000
Work	8	5	10	4	4	5
Shop	13	5	21	13	14	11
Social-Recreation	63	44	38	40	34	38
Personal Business	8	16	10	18	14	16
Eat Meal	0	3	0	0	4	5
School	8	27	21	25	30	25
Total	100	100	100	100	100	100

Source: Yukubousky and Politano, 1974: 51.

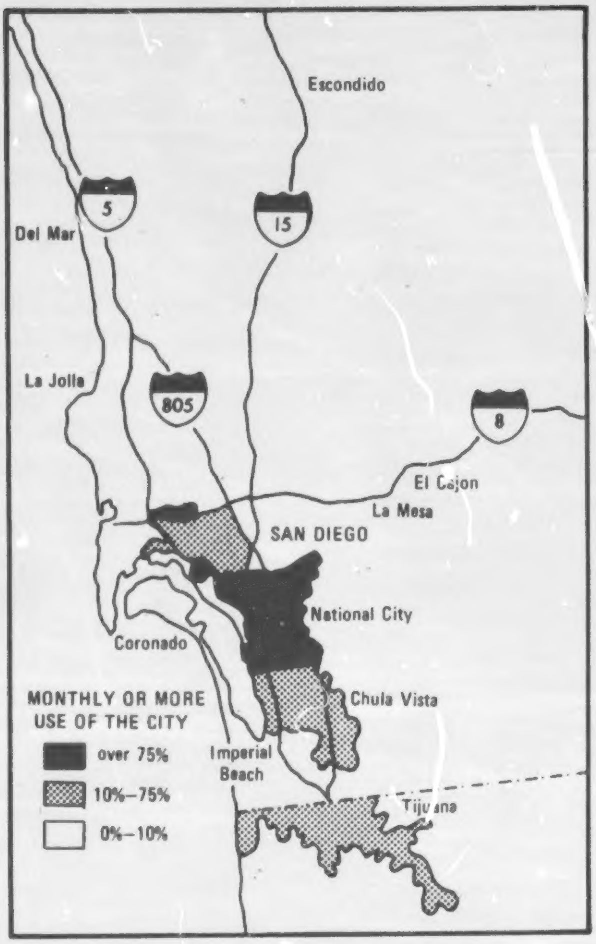

Escondido
5
15
Del Mar
La Jolla
805
8
El Cajon
La Mesa
SAN DIEGO
National City
Coronado
Chula Vista
Imperial Beach
Tijuana
MONTHLY OR MORE USE OF THE CITY
over 75%
10%–75%
0%–10%

Figure 30. Use of the region by residents of southeast San Diego between the ages of 14 and 18 (Modified from Appleyard and Lynch, 1974: 8).

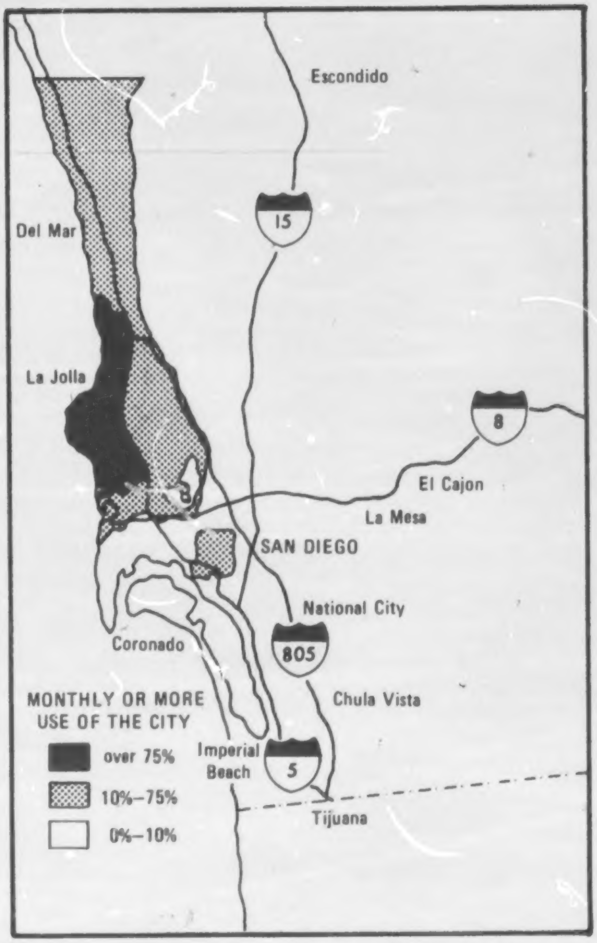

Escondido
15
Del Mar
La Jolla
8
El Cajon
La Mesa
SAN DIEGO
National City
805
Coronado
Chula Vista
Imperial Beach
5
Tijuana
MONTHLY OR MORE USE OF THE CITY
over 75%
10%–75%
0%–10%

Figure 31. Use of the region by La Jolla high school students. Students without automobiles are constrained by distance and physical barriers. On the west of the "over 75%" zone is the ocean and to the east is Interstate 5. However, the San Diego urbanized areas spreads over most of the mapped area. The roughly square area disjoint from other heavily used areas is Balboa Park and the San Diego Zoo (Modified from Appleyard and Lynch, 1974: 8).

Transportation Problems of the Handicapped and Elderly

An attempt to identify a particular event or other beginning point of the present nationwide interest in the problems of the elderly and handicapped in our country meets with some difficulties. It is no doubt part of a larger growing awareness of social and ethnic problems of our society. Some observations point to the Social Security and Medicare programs that now cover larger and larger proportions of the population. Certainly our awareness of the problems of these groups has been heightened by Harrington's (1963) book, *The Other America—Poverty in the United States*, which describes the living conditions of many elderly and handicapped persons and discusses some government programs which had been begun in the sixties to help these disadvantaged. But 15 years later the plight of these people is pretty much the same. Handicapped persons have been overlooked more than any other disadvantaged group and transportation is only one of their many and long-standing problems. However, transportation affects many of the other problems of the elderly and handicapped, such as access to services, information about jobs and education, and even their self-concept.

Special transportation can improve the plight of these individuals by reducing the actual and perceived travel barriers, as well as the physical or operational problems that inhibit their use of a transit system (Table 16). Physical barriers can be associated with the vehicles themselves, such as high front steps and inadequate stabilizer grips down the aisles. A lengthy walk to reach a transportation terminal can also be a barrier. Insufficient shelter while waiting for the vehicles is a barrier at the transit stop itself. Operational barriers center on local frequency of service and frequent transferring, and crowds at terminals and transit stops can also present barriers.

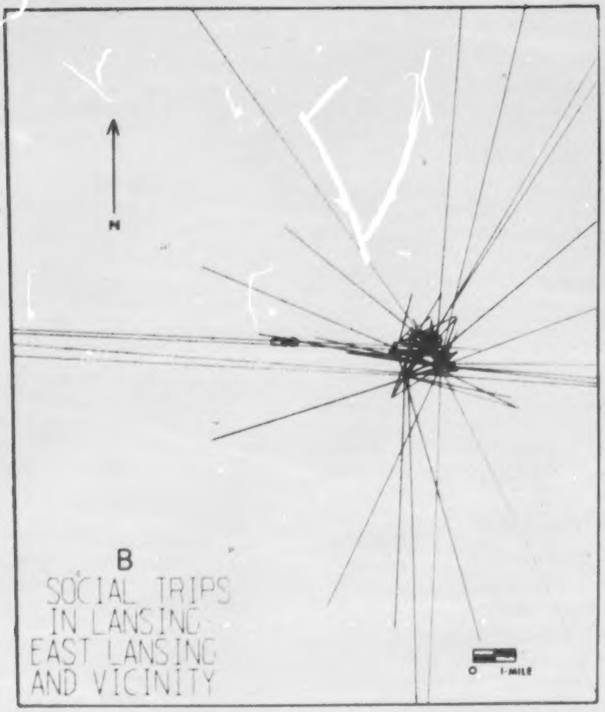


Figure 32. Social trips made by Michigan State University students living on campus are 1) tightly clustered about student housing, and 2) dispersed out of the city to visit relatives and to pick up more money.

The Handicapped

It is difficult to measure the number of people who are immobile because there have been no inventories taken of those who report handicaps related to transportation. Some projections can be made by using national Health Survey statistics (Table 17) which give estimates for 1970 by each handicapped class. In 1970 approximately 13,370,000 people were experiencing major difficulties using public transit. Here the handicapped are divided into elderly and nonelderly groups, and into institutionalized groups. The institutionalized proportion includes those who are in homes for the aged, and homes and institutions for the physically handicapped. The noninstitutionalized groups include people with chronic conditions and those with acute conditions. But what constitutes a transportation handicap is still open to question. The Conference on Transportation and Human Needs (1972) numbered both the permanently and temporarily disabled at 40 million. A Department of Transportation study (1973) defines transit-related physically handicapped persons as "persons who by reason of illness, injury, age, congenital malfunction, other permanent or temporary incapacity or disability, including those who are nonambulatory wheelchair-bound and those with semiambulatory capabilities, are unable without special facilities or special planning or design to use mass transportation facilities as effectively as persons who are not so affected."

Of the 13,370,000 who have difficulty with transit, an estimated 5.3 million cannot use transit in any manner (Table 18). Some cannot even leave their homes (Table 18). Recent figures for the overlap of both handicapped and elderly count of the mutually exclusive populations of each class (Table 19). But we know little about the precise areal distribution of handicapped, except that they are almost equally divided among city, suburb, and rural areas (Table 20). They comprise about twelve percent of the population and, because of their areally spread nature, are extremely difficult to serve with special vehicles. *The Handicapped and Elderly Market for Urban Mass Transit* (D.O.T., 1973) details the transit availability within acceptable walking distances and also transit which cannot be presently used (Figure 33). Estimates of the number of handicapped affected by certain functional requirements for travel can be made by examining classes of handicapped that cannot perform these functions by themselves (Table 21).

TABLE 16. TRAVEL BARRIERS

Physical Barriers	Operational Barriers
Vehicles	Vehicles
High step required to enter	Frequency of service
Difficult to get into or out of seats	Driver assistance/attitude
Seats not available/forced to stand	Acceleration/deceleration
Difficult to reach handholds	Information presentation
Cannot see out for landmarks	Schedules maintenance
No place to put packages	Inadequate or inappropriate routes
Cannot see or hear location information	Too many transfers
Nonvisible signs	
Terminals	Terminals
Long stairs	Employee assistance/attitude poor
Long walks	Information clarity and dissemination
Poor fare collection facilities	Length of stops too short
Poor posting of information	Crowd flow nondirected
Insufficient seating	Little or no interface with other modes
Little interface with other modes	
Transit Stops	Transit Stops
Insufficient shelter	Poor location: for safety for convenience
Platform incompatible with vehicle	
Inadequate posting or information	Not enough stops
	Information displayed insufficient or confusing

Source: Department of Transportation, 1973: 13.

TABLE 17. THE NATIONAL NUMBERS OF HANDICAPPED WITH TRANSPORTATION DYSFUNCTIONS*

Handicap Class	Elderly Handi-capped	Nonelderly Handi-capped	Total Handi-capped
Noninstitutional			
Chronic conditions			
Visually impaired	1,460,000	510,000	1,970,000
Deaf	140,000	190,000	330,000
Uses wheelchair	230,000	200,000	430,000
Uses walker	350,000	60,000	410,000
Uses other special aids	2,290,000	3,180,000	5,470,000
Other mobility limitations	1,540,000	1,770,000	3,310,000
Acute conditions	90,000	400,000	490,000
Institutionalized	930,000	30,000	960,000
Total	7,030,000	6,340,000	13,370,000

* 1970 estimate of those people who can't use transit or who use transit with difficulty.

Source: Department of Transportation, 1973.

The Elderly

The 1970 Census listed 20,066,000 Americans as elderly (over 65 years of age), comprising about ten percent of the United States population. Various agencies use a lower age, however; the Social Security Act and Old Age Insurance denotes elderly as those age 62 or older. The Older Americans Act places them at age sixty. Urban Mass Transportation Administration (UMTA) fare discounts begin at age 65, and the California Welfare and Institutional Code places elderly at age sixty. The elderly are not evenly distributed throughout America and are found more frequently in older city neighborhoods. There is also a recent trend of the elderly to move to retirement housing both in the cities and in the suburbs. Many now live in retirement communities, many of which use mobile homes. The elderly are spread about equally among cities, suburbs, and rural towns, with rural areas having a slight edge. There has been a recent tendency for high residential mobility and migration on the part of the middle-aged, leaving the elderly without local relatives. An estimated 7.4 million of the elderly are handicapped, and another 5 million are poor (Figure 26). An estimated twenty percent are employed.

TABLE 18. HANDICAPPED UNABLE TO USE TRANSIT*

	Under 65	65 and Over	Total
Can go out, but can't use transit	1,153,000[a]	1,153,000[b]	2,306,000
Can't leave home	878,000[a]	878,000[b]	1,756,000
Institutional	30,000[c]	930,000[c]	960,000
Acute conditions (temporary)	185,000[d]	50,000[d]	235,000
Total	2,246,000	3,011,000	5,257,000

* A minimum of 5.3 million of the nation's 13.4 million transit disadvantaged are probably unable to use transit.

[a] Social Security survey of the chronically handicapped, 1966.

[b] Transport Systems Center estimate of equal incidence over 65.

[c] Census of Population, 1970.

[d] HEW National Health Survey, 1970, estimated.

Source: Department of Transportation, 1973.

TABLE 19. OVERVIEW OF TARGET GROUP STATISTICS

Total elderly	20,066,000
Total handicapped	13,370,000
There are significant overlaps	
Elderly and handicapped total (with no double counting)	26,406,000
This breaks down to three relevant mutually exclusive classes:	
Handicapped — Elderly	7,030,000
Handicapped — Nonelderly	6,340,000
Elderly who are not handicapped	13,036,000
Grand Total	26,406,000

Source: Department of Transportation, 1973.

Interest in transportation problems of the elderly has come about through their increasing concentrations that give some areas, such as Miami Beach, Sun City, Arizona, and Vista, California, large elderly populations. These are major users of public transportation for nonwork travel. Some cities offer special services such as dial-a-ride vans and buses that service door-to-door. The meals-on-wheels programs in many cities provide food at an inexpensive rate to shut-ins. The frequency of travel out of the home depends largely upon the availability of transportation for the elderly.

One study showed that because transit is not readily available, elderly persons take fewer trips than they would like (Carp, 1974). Carp compared elderly and middle-aged San Francisco residents by type of travel used for various types of trips (Table 22). One can see that elderly cannot make many trips, such as going to parks, out for entertainment, to the country, and out to eat. They must make essential but frequent trips for food because of their inability to carry heavy loads. They travel to visit friends less frequently than the middle-aged group. Both groups make most of their trips within the community by auto and principally as

TABLE 20. PHYSICALLY HANDICAPPED BY LOCATION, 1970

Location	Under 65 Years Old	Over 65 Years Old
Central city	600,000	1,300,000
Suburban	700,000	1,200,000
Rural	700,000	1,500,000
Total	2,000,000	4,000,000

Source: *Manpower Report to the President*, 1971.

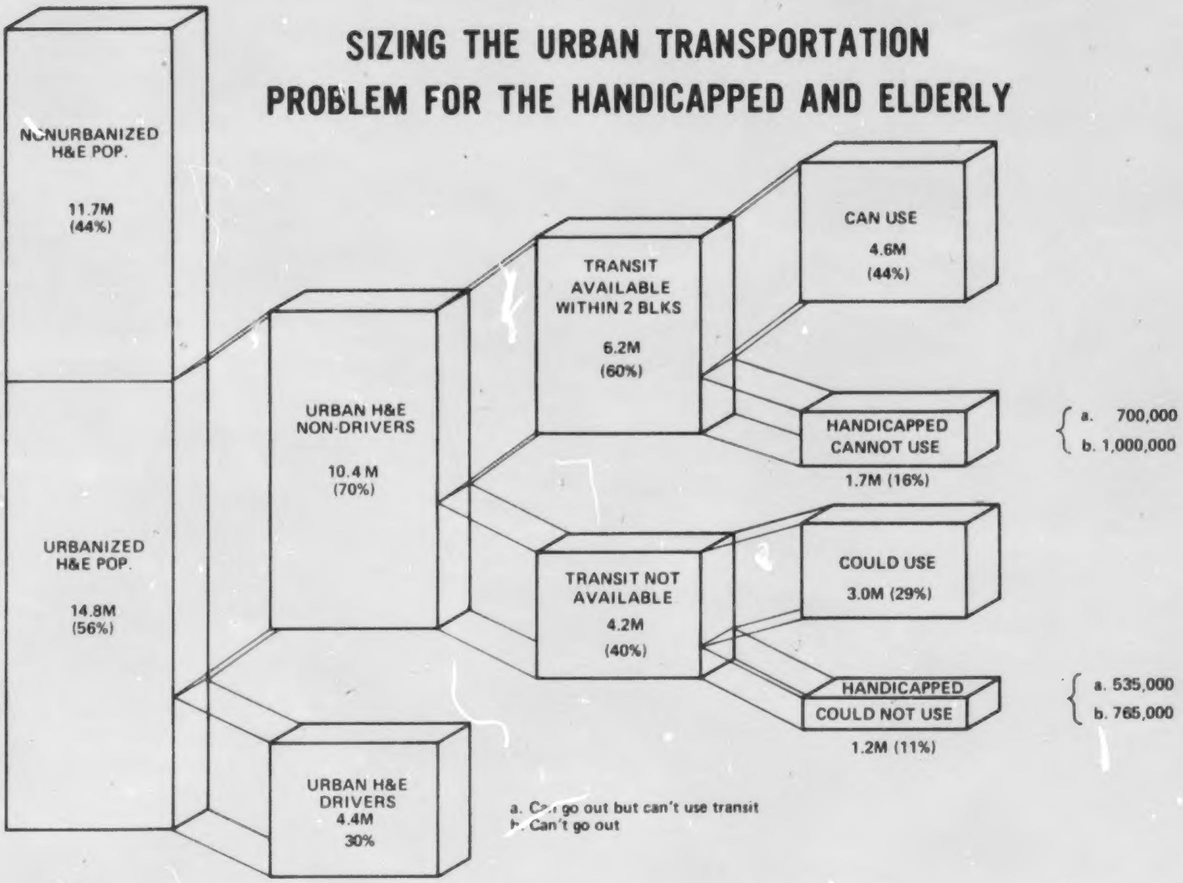

SIZING THE URBAN TRANSPORTATION PROBLEM FOR THE HANDICAPPED AND ELDERLY
U. S. HANDICAPPED & ELDERLY POPULATION 26.5M (100%)
NONURBANIZED H&E POP.
11.7M (44%)
URBANIZED H&E POP.
14.8M (56%)
URBAN H&E NON-DRIVERS
10.4 M (70%)
URBAN H&E DRIVERS
4.4M
30%
TRANSIT AVAILABLE WITHIN 2 BLKS
6.2M (60%)
TRANSIT NOT AVAILABLE
4.2M (40%)
CAN USE
4.6M (44%)
HANDICAPPED CANNOT USE
1.7M (16%)
a. 700,000
b. 1,000,000
COULD USE
3.0M (29%)
HANDICAPPED COULD NOT USE
1.2M (11%)
a. 535,000
b. 765,000
a. Can go out but can't use transit
b. Can't go out

Figure 33. From Department of Transportation, 1973.

auto driver trips, although the middle-aged make every type of trip more commonly than the elderly. The elderly are far less likely to be drivers themselves, or to own automobiles.

Another comparison can be made concerning the trip frequency per day according to age groups, stratified by both income and car ownership (Table 23). The most striking difference for this Rochester, New York study is between age groups, with the elderly producing less than half the number of trips of the middle-aged group (Yukubousky and Politano, 1974). Elderly families with one car take two to three times the number of trips of those with no car. Trip production does not seem to vary strongly with income in this study.

Because the elderly are less mobile than the middle-aged, their spatial opportunities are much less, a situation related probably more to situation than to preference. Reasons mentioned for giving up driving are economic status, health problems, and loss of licenses (Carp, 1974:69). Problems associated with driving center on physical changes, such as vision, reflexes, nervousness, and crippling (Table 24). Changes in driving conditions also play a role (Table 24). As a result, older people are less able to drive and own cars and, therefore, become dependent on public transportation, which in many cases means buses. But the elderly experience problems with public transportation as well, not to mention the level of service and the limited configuration of the routes. The trip itself can be a difficult one (Table 25). Many of these problems were severe enough for elderly San Franciscans not to travel (Carp, 1974). But San Francisco bus service would have to be rated as good, compared to many other cities.

The recent new approaches toward mass transit in the country have been particularly important for the elderly. The Urban Mass Transit Act of 1970 explicitly asked municipalities to aid the elderly in meeting their transit problems. Walking is an alternative and elderly have used it because of the lack of other transportation available, and because older sections of town in which they live frequently have services within walking distance. But the degree to which the elderly depend upon walking also presents certain problems (Table 26). Apparently the principal areas of concern are getting to and from the bus itself and getting on and off without a mishap. Those of us who do not take the bus regularly or who have little trouble getting about rarely think of these problems. A serious fall at advanced age can be fatal. Over twenty percent of the people interviewed had fallen and most of the others had witnessed a fall. Although elderly over age 65 comprise only ten percent of the population, they contribute 25 percent of the pedes-

TABLE 21. HANDICAP CLASS RELATED TO FUNCTIONAL REQUIREMENTS FOR TRAVEL

Function	A	B	C	D	E	F	G
Walk or go more than one block				X		X	
Move in crowds	X		X	X	X	X	X
Stand or wait				X	X	X	
Board quickly	X		X	X	X	X	X
Climb shallow, short stairs			X	X			
Climb steep or long stairs			X	X	X	X	X
Use inclines				X			
Deposit exact fare	X			X	X	X	X
Maintain balance while standing in moving vehicle (with aid of pole, seat, etc.)			X	X	X	X	X
Sit down, stand up			X	X			
Respond to visual cues	X						
Respond to audio cues		X					

X means: Cannot perform function alone with substantial difficulty.
Handicap Class Identifiers and Numbers Affected:

A. Visually Impaired (1,970,000)
B. Deaf (330,000)
C. Uses Wheelchair (430,000)
D. Uses Walker (410,000)
E. Uses Other Special Aids (5,470,000)
F. Other Mobility Limitation
G. Acute Conditions (490,000)

Source: Department of Transportation, 1973.

trian deaths in the United States (Cantilli and Schmelzer, 1970). But it is not clear to what degree these statistics reflect the reduction in agility and motor skills because of age, or the degree to which elderly live in more congested areas and use walking as a mode of travel to a proportionally greater degree than the population as a whole (Table 26).

Present Travel Behavior of the Handicapped and Elderly

One element of travel behavior of many elderly and handicapped is the time of day during which they travel. They make about two-thirds of the trips during off-peak times between 9:00 a.m. and 4:00 p.m. (Table 27). Given the elderly's difficulty of driving in heavy traffic, it could be assumed that trip making by this group occurs at times specifically chosen to avoid the normal peak hours of 8:00 a.m. and 5:30 p.m. Few trips for the elderly occur before 9:00 a.m.; and because they make most trips for personal business and shopping, the 9:00 a.m. point corresponds to the opening of many establishments. For the younger handicapped, the temporal distribution of travel closely resembles the standard diurnal cycle, because of their school trips, but the major tripmaking, 63 percent, occurs between 9:00 a.m. and 4:00 p.m. as well.

It is estimated that less than ten percent of elderly persons' travel occurs before 9:00 a.m., whereas almost twenty percent occurs from 4:00 to 7:00 p.m. Few night trips are made by either group. The time distribution of trips by elderly and handicapped persons, when taken in conjunction with the latent demand figures noted above, suggest that to the extent existing public transportation services, fixed route buses, school buses, and taxicabs, have excess capacity during off-peak hours, there would be potential for using these resources to fill the unmet needs of these groups.

The majority of trips made by the elderly and handicapped are short, probably because of their limited action spaces which tend to reduce information on other areas of the city. Data from the 1966 origin-destination survey in San Diego provided additional corroboration on the dominance of short trips by elderly persons. Origin and destination tabulations were prepared for trips made by persons age sixty or over, regardless of mode of transportation, for a set of twenty large zones specifically created for this study. Of all trips by elderly persons reported in 1966, 58 percent occurred within these zones, compared to only 24 percent intrazonal trips made by other age groups. If the transit services are to be improved for the elderly and the handicapped, planners should encourage improved demand responsive services that can operate efficiently in serving small areas.

Another principal difference in travel behavior between the elderly and handicapped group and the general population occurs by trip purpose (Table 28). In San Diego shopping, social-recreation, and medical trips are more frequently made by the elderly, with work trips and other trips made less frequently. "Other" trips include going out to eat, a variety of personal business trips, trips to change the mode of transportation, and driving to serve passengers in one's car. Elderly and

TABLE 22. PERCENTAGE DISTRIBUTION OF TRANSPORTATION MODES BY TRIP PURPOSES FOR TWO AGE GROUPS

Trip purpose		Transportation Used				
		% Drive	% Driven	% Public Tr.	% Walk	% Do not go
Food	65+	33	14	11	31	13
	35–44	60	7	5	15	15
Other shopping	65+	32	11	20	20	18
	35–44	61	7	13	11	10
Friends nearby	65+	22	5	5	36	32
	35–44	43	3	3	30	24
Other friends	65+	35	15	18	2	29
	35–44	61	8	11	1	17
Religious	65+	21	10	7	18	42
	35–44	30	4	2	14	50
Doctor/Dentist	65+	33	13	30	9	14
	35–44	59	5	16	4	14
Out to eat	65+	25	11	5	11	46
	35–44	59	9	3	9	21
Entertainment	65+	12	5	4	7	71
	35–44	53	9	6	5	27
To the country	65+	25	16	7	1	52
	35–44	54	11	5	0	29
To the city	65+	17	9	20	3	50
	35–44	42	6	12	38	38
Parks	65+	8	4	8	6	76
	35–44	48	5	6	13	28

The rows do not total 100% because a few respondents used taxis or cycles, and a few who no longer took such trips named the mode they formerly used.
N = 717; Bay Area, 1972.
Source: Carp, 1974: 67.

TABLE 23. ALL PURPOSES TRIPS PER PERSON PER DAY URBAN AREAS—ROCHESTER

	Age 65+		Age 20–64		Age 5–19	
Income Range	0 car	1 car	0 car	1 car	0 car	1 car
<$3,000	.38	1.59	.79	1.83	.42	1.26
$3,000–$8,000	.67	1.70	1.33	3.30	.67	1.11
>$8,000	—*	1.50	1.85	3.66	.75	1.34
			Capital District			
<$3,000	.39	1.27	.72	2.36	.22	—*
$3,000–$8,000	.91	1.25	1.57	2.84	.39	.71
>$8,000	—*	—*	—*	3.44	—*	.93
			Rural Areas—Statewide			
<$3,000	.05	.49	—*	2.50	—*	—*
$3,000–$8,000	.02	1.14	.54	2.15	—*	.08
>$8,000	—*	—*	—*	2.34	—*	.05

* Incomplete data (data having less than thirty records).
Source: Yukubousky and Politano, 1974: 37.

TABLE 24. REASONS OLDER PEOPLE ARE LESS SECURE ABOUT DRIVING

Reason	Percent
Age-changes in people:	
Vision	82
Slowness in responding	79
Nervousness	75
Crippling	62
Lack of confidence	58
Difficulty in adjusting to new things	55
Changes in driving conditions:	
Speed of traffic	60
Number of cars on road	51
Freeways and interchanges	51
Streets and roads	23
Design of cars	17
Traffic signals	14
Other drivers	3

Percents do not total 100 because categories are not mutually exclusive.
N = 433; San Antonio, 1968–1969.
Source: Carp, 1974: 70.

handicapped are not as likely to go out after dark and they engage in fewer trips to eat a meal. Additionally they have less need to change modes or serve passengers as these purposes are usually associated with trips to work and to school. They are less likely to make work trips because of age and physical and mental disabilities.

A study of Rochester, New York (Yukubousky and Politano, 1974), shows results similar to those presented for San Diego in Table 29. The low income elderly who do not own automobiles make on the average only twenty percent of the volume of trips made by elderly in households in which a car is owned. Total trip volumes of the carless elderly are here shown to vary with income, but total trip volumes of those who have automobiles available are relatively constant across income categories. Apparently transit and taxi trips for those without cars are more sensitively felt than are extra trips for car owners. Work trips are less important to elderly who have given up automobiles, but shopping trips are important to all categories. The low income elderly without cars make an average of one shopping trip every two weeks, but those with a car make a shopping trip every three to four days. In Rochester, the percentage of shopping trips by the elderly decreases as the percentage of work trips increases. The authors give two possible explanations for this. Shopping trips serve as social-recreational trips for the nonworking elderly who have more leisure time, and the elderly working downtown shop over the lunch hour while on foot.

TABLE 25. PROBLEMS WITH BUS TRIPS

Problem	Percent
Walk to transit	38
Tiring wait for vehicle	80
Lack of shelter while waiting	88
Afraid at bus stop	66
Fear of falling while boarding	65
Fear of being late	63
Fear of doors	59
Keeping footing on vehicle	70
Missing the right stop	58
Drivers rude, unhelpful	39
Transferring	36
Fear falling while getting off	77
Too tired to walk home	52
Afraid to walk home	72

N = 899; San Francisco, 1970.
Source: Carp, 1974: 71.

TABLE 26. PROBLEMS WITH WALKING

Problem	Percent
Destinations too far	83
Depends on weather	78
Hills	72
Fears	65
Tired, feet hurt	55
Takes too long	52
Health problem	37
Traffic confusing	36

Percents do not total 100 because categories are not mutually exclusive.
N = 899.
Source: Carp, 1974: 76.

Latent Travel Demand

Latent travel demand can be defined as the number of trips per day that could be expected if the carless elderly had transit immediately available (similar to service provided by car). There is not a large difference in latent demand between the low and the middle income ranges. The shopping trip purpose has the largest latent demand of approximately 0.25 trips per weekday. This figure does not vary much for increases in income. It is possible that elderly without cars make a greater proportion of shopping trips on foot than they would like, and the availability of more transportation would reduce these. Also, more transit could provide them with a greater selection of available shopping areas. Social and recreational trips appear to have an income sensitive latent demand. Apparently elderly with less than $3,000 would make one trip a week extra, whereas those with $3,000 to $8,000 would add one a month. Personal business

TABLE 27. TIME OF DAY TRIPS MADE

Time of Day	Elderly % of Daily Trips	Younger Handicapped % of Daily Trips
Before 6 a.m.	—	1
6–9 a.m.	8	19
9 a.m.–Noon	48	27
Noon–4 p.m.	25	36
4–7 p.m.	19	13
After 7 p.m.	—	4

Source: San Diego Comprehensive Planning Organization, 1976: 27.

TABLE 28. TRIP PURPOSES IN SAN DIEGO

	Percent of Daily Trips		
Trip Purpose	Elderly	Handicapped	General Population*
Shopping	28	20	18
Social/Recreation	26	26	15
Medical	13	12	2
Work	17	20	31
Education	3	7	5
Religion	3	2	1
Other	10	15	28
Total	100	100	100

* Including elderly and handicapped.
Source: San Diego Comprehensive Planning Organization, 1976: 29.

trips to medical centers, banks, counseling centers, churches, and to legal services would increase decidedly, but going out to eat a meal has much less demand than other activities. Apparently the fear of traveling at night tends to keep this category lower. Adding the latent demand for all trip types together yields an increase of from 0.7 to 0.9 one-way trips per day (counting 45 percent of all trips as homeward). These values represent a doubling of travel, given that autos were available. The latent demand for public transit would probably be less than the above figures. Public transportation is more important for the urban elderly without automobiles. In the city of Rochester individuals who are 65 or over take nine percent of all public transit trips, although this group makes up 14 percent of the general population in that city (Yukubousky and Politano, 1974). The relative amount of transit trips to work increases as income increases, but the amount of social-recreational trips decline.

Rural Transportation

The rural disadvantaged remain possibly the most isolated group from the mainstream of modern American society because of their inability to travel. In some cases, this immobility results from their inability to pay the price for existing transportation services. In other cases, transportation services are nonexistent for persons not owning automobiles. Many rural communities have adequate road systems providing access to major cities. Those with automobiles in rural areas, therefore, are in relatively good shape. Compared to this mobile group, those who do not have an automobile or who are not able to drive, are frequently unaware of available measures to improve their living standards or are unable to take advantage of those they know about. The social and economic desolation fostered by distances is compounded by the expense and difficulty of traveling in rural areas. This lack of opportunity to participate in the activities and transactions of modern society is probably central to the many cultural and economic problems of rural residents. The stark opening scenes of the movie, *Deliverance*, visually depicted this dilemma of the people and landscape of rural Georgia.

Because most origin-destination surveys are conducted in cities of 50,000 or more, there have been few studies of the transportation problems of the rural disadvantaged. One exception is the study by McKelvey and Dueker (1974) of a telephone actuated mini-bus system for the rural elderly in Washington County, Iowa. Recently public agencies have directed their attention and resources toward the problems of rural residents. Such programs include the Older Americans Act of 1971, the Rural Development Act of 1972, and the Federal Highway Act of 1973. Poverty-stricken regions, in which nearly all of the population is disadvantaged, are hit the hardest. One such region is Appalachia, and most of its residents are spread throughout the region in small, isolated, and steeply sloping valleys. In 1964 plans were made to link the dispersed population centers with an interstate highway to help the population gain a larger share of the economic and social benefits available in neighboring communities throughout Appalachia. But a decade later, the benefits of the planned system had not accrued because of local interests, and benefits were enacted at the expense of region-wide priorities. The majority of funds were used for intratown development rather than interregion transportation and communication, which left these rural spots without the link that they so desperately needed.

Skid Row Transportation Problems

Although we know very little about the transportation problems of the rural disadvantaged, we know even less about the opposite end of the social continuum, the city center. There are numerous studies on life on skid row (Harris, 1956; Bendiner, 1961; Bogue, 1963; Wiseman, 1976; and Bahr, 1970), although none treats the residents' movement territories, trip making behavior, or transportation problems in general.

We know little about the mobility problems of the downtown elderly poor. One recent study examined the mobility of such people living in one hotel in downtown San Diego (Stutz, 1976). The area near the subject hotel is the city's skid row, and it is filled with penny arcades, pornography shops, X-rated theaters, strip joints, taverns, pawn shops, tattoo parlors, and second-hand clothing and furniture stores. Several social service agencies, including the Salvation Army, the Goodwill, the City Rescue Mission, and several churches have storefront "helping" facilities. Within this area are nine hotels where marginally subsistent individuals can find lodging. The largest, best known, and oldest of these is the Golden West Hotel, where more than 400 people live. From its original population of workingmen, the population has shifted to nonworking, marginally subsistent pensioners. The manager estimates the average age of the residents to be 65; of these, 300 are pensioners with an average income of $150-200 per month, and 75 percent permanent residents. Drunkenness and vagrancy are not major problems with this group, as most have moderately stable lives. The subject group is probably best classified as elderly poor, rather than "skid row bums." The hotel has only twenty females and it serves a small subpopulation of young persons, each of whom, although ambulatory, has a physical disability.

TABLE 29. ROCHESTER ELDERLY TRIP RATES BY PURPOSE

	Trips/Person/Day					
	Zero Car Income Range			One Car Income Range		
	<3K	3–8K	>8K	<3K	3–8K	>8K
Work	.02	.09	—*	.10	.16	.19
Shop	.07	.05	—*	.31	.31	.23
Social Recreation	.05	.12	—*	.18	.15	.18
Personal Business	.04	.07	—*	.17	.17	.17
Eat Meal	.01	.01	—*	.04	.05	.03
Total Nonhome	.19	.34	—*	.80	.84	.80
	Percent Distribution (%)					
Work	11	26	—*	13	19	24
Shop	37	15	—*	39	37	29
Social Recreation	26	35	—*	22	18	23
Personal Business	21	21	—*	21	20	20
Eat Meal	5	3	—*	5	6	4
	100	100	—*	100	100	100

* Insufficient data.
Source: Yukubousky and Politano, 1974: 40.

Compared to other hotels nearby, this hotel is relatively clean and comfortable. Residents prefer to live here for a number of reasons, including relatively cheap rent ($50 per month without bath) with housekeeping services provided, the availability of inexpensive cafes in the area, and a socially similar and understanding group of fellow residents.

Transportation is a principal need not completely met by present conditions, even though a bus stop is one half-block from the hotel. When interviews were gathered from a random sample of 32 hotel residents and compared to a survey conducted by the Comprehensive Planning Organization of San Diego, different conditions from the CPO survey were found (Table 30). The majority of the hotel residents ride the bus, but a large group walk to destinations over a mile away. Elderly in the rest of the city are more auto-dependent, but residents of the Golden West are sensitive to transit costs and to health problems, and this limits their use of public transportation. The residents of the Golden West Hotel are more homogeneous than the residents of other downtown areas. They make most of their trips for food and drink, recreation, and walking. Although there are a variety of eating and drinking establishments found within several blocks, they use the grill in the hotel lobby more frequently than the other establishments. Longer distance trips, such as to a doctor or dentist, or to Balboa Park (three miles north) or San Diego Bay (two miles west), are usually made via bus (Figure 34). Almost no one owns a car, as most of the travel is up and down 4th and 5th Avenues, but the composite interaction or behavior space has east and west extensions.

There is little interaction south of Market Street, although Market Street is only one block south of the hotel, because the residents think this area is dangerous. Stress in this area reportedly centered on the violence of black youth groups. Similar stress zones have been identified for residents traveling through the black inner city (Ley, 1974). Routes may avoid certain areas that are perceived to be dangerous because of possible violence from gangs of blacks (Figure 35).

A westward extension of the movement field runs toward San Diego Bay on F Street. Even though it is a short distance to San Diego Bay (about two miles), and the amenities are high, this represents a formidable journey to Golden West residents. The eastward extension of the field centers around C Street and extends to the YMCA and the Senior Center at 10th Avenue and C Street. The public library is also popular mainly because the soft chairs in the lobby offer a good place to watch people go by. Eleventh Avenue, leading to Cabrillo

TABLE 30. TRANSPORTATION NEEDS AND USE OF ELDERLY POOR MALES IN DOWNTOWN SAN DIEGO

	San Diego	Center City	Golden West
Nutrition			
Have problem getting meals	12%	16%	22%
Health: severe problems	15%	20%	37%
Transportation Use			
Auto	38%	14%	5%
Taxi	7%	10%	5%
Bus	37%	57%	62%
Walk	7%	14%	26%
Other	11%	5%	2%
Transportation Problems			
Taxi too expensive	23%	33%	62%
Bus too expensive	22%	10%	15%
Bus stop too remote	19%	5%	2%
Health prevents riding bus or taxi	13%	23%	31%
Not enough buses on Sunday	8%	13%	10%

Source: Stutz, 1976.

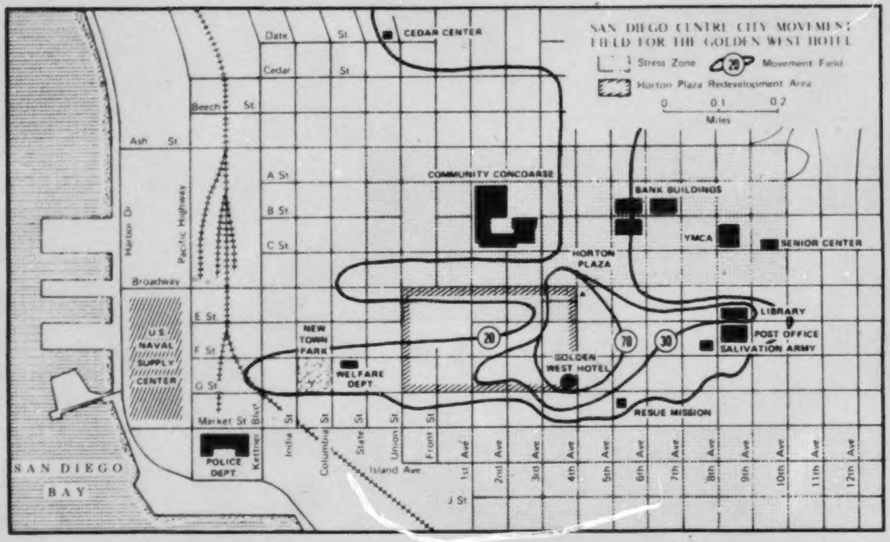

SAN DIEGO CENTRE CITY MOVEMENT FIELD FOR THE GOLDEN WEST HOTEL
Stress Zone
Movement Field
Horton Plaza Redevelopment Area
0
0.1
0.2
Miles
CEDAR CENTER
COMMUNITY CONCOARSE
BANK BUILDINGS
YMCA
SENIOR CENTER
HORTON PLAZA
LIBRARY
POST OFFICE
SALIVATION ARMY
GOLDEN WEST HOTEL
RESUE MISSION
NEW TOWN PARK
WELFARE DEPT
POLICE DEPT
U.S. NAVAL SUPPLY CENTER
SAN DIEGO BAY
Date St
Cedar St
Beech St
Ash St
A St
B St
C St
Broadway
E St
F St
G St
Market St
Island Ave
J St
Harbor Dr
Pacific Highway
Kettner Blvd
India St
Columbia St
State St
Union St
Front St
1st Ave
2nd Ave
3rd Ave
4th Ave
5th Ave
6th Ave
7th Ave
8th Ave
9th Ave
10th Ave
11th Ave
12th Ave
20
70
30

Figure 34. Each line on the movement fields indicates the proportion of elderly poor residents living in the Golden West Hotel who would be likely to use those portions of downtown indicated. This hotel is within an active redevelopment area. The relocation department is using this study to determine in part if the Golden West should be razed (Stutz, 1976).

Freeway, limits movement on the east, with Horton Plaza being the center of the movement field. The plaza is a one-half square block pedestrian center, and is a window on the fast-paced world. Broadway separates the zone of discard of the Central Business District to the south from the zone of assimilation to the north. Broadway is the principal retail street, and it receives the greatest downtown foot traffic. Additionally, the Plaza is the end of the line for several bus routes. Navy men on shore leave, art exhibitors, soap box speakers, hippies, and prostitutes are all in this area. A major outing for many residents of the Golden West is the three-block walk up to Horton Plaza. North of Broadway is a less stressful area. It is the white-collar businessman's zone. On C Street, between 1st and 3rd Avenues, are the city offices and the community concourse convention center. The newest skyscrapers in San Diego are located on 6th Avenue and B Street. Each is a bank building and this has created another perceived node of the elite. Hotel residents pass through this area but will not generally deviate much from 4th or 5th Avenues, at least on weekdays. Several activity centers to the north also attract hotel residents. One is the community center for the elderly at Union and Date Streets and the other is the San Diego Zoo and Park.

Programs for the Handicapped and Elderly

There have been few transportation programs for the handicapped per se, with the exception of programs for retarded children. Most relief measures for the handicapped are also offered to the elderly as well, and consist of fare reductions in which elderly or handicapped pay half fares or less. The other type of program under experimentation involves using special vehicles for the elderly and handicapped, such as vans or dial-a-ride buses.

Fare Reduction

By 1972 there were over 100 programs of reduced fares in the country, most of which charged half fares at off-peak hours (Falcocchio and Cantilli, 1974). Crain (1973) listed 28 of the major systems in the United States which had such fares (Table 31). Overall ridership has increased about 15 percent, showing the need not only for cheaper fares but for better service. Overall, however, the transit companies have lost revenue with such fare reductions (Table 32). But nationally, the trend is clearly to give the elderly lower rates than the general population on public transportation, even though this involves sacrificing income. The Chicago Transit Authority lost approximately $9.5 million in 1973 because of its new policy of letting persons age 65 or older ride buses and elevated-subway trains at a reduced fare of twenty cents. The Washington, D.C. Transit Authority also charges elderly passengers lower rates. In its first ten months of operation during 1969-1970, the Reduced Fare Program for older New Yorkers registered over 600,000 persons, and senior citizen ridership went up at least 25 percent. Persons aged 65 or older may ride Metro transit buses anywhere in King County, Washington (which includes Seattle), for ten cents per ride or they may pay $2 per month for a pass for a limitless number of rides. There are no income restrictions; senior citizens and the handicapped also receive a twenty percent reduction in taxi fare regardless of income. In West Virginia an innovative pilot program is being attempted which would distribute transportation stamps to persons over sixty and those in low income groups, in the same manner as food stamps, with the rider paying an amount based on income. It is estimated that more than 150 communities now have fare reduction programs for older people. The amount of the reduction usually is about 35 to fifty percent. Most programs restrict travel to off-peak hours but the trend is to remove all restrictions and operate fare reductions on a 24-hour basis. Morlok *et al.* (1971) found that reduced fares generally led to an increase in ridership averaging 15 percent.

Demand Responsive Transportation

Conventional public transportation cannot provide immediate door-to-door service. But it is precisely this type of transit that is needed in rural areas, and by the elderly and handicapped who have ambulatory physical disabilities. Taxicabs come closest to this plan, but their fares are too high to alleviate the problem. The large portion of rural dwellers who need transportation, as well as the elderly and handicapped of the city, are often poor as well. The economics of line-haul operations determines the fixed route service of most transit companies. These companies cannot adequately service the lower density areas where the bulk of the United States population now resides. Moreover, traditional transit systems were not designed to accommodate the elderly or handicapped populations. Poor service in low density areas reflects the lower quantity of traffic and the increased dispersion of trip origins and destinations. Thus, public transit involvement in some areas has been characterized by infrequent and unreliable service (a lack of any service in some areas), inflexible routing, poor information on scheduling, poor connecting service, and exposure to crime. Slow speeds and delays, crowding and lack of comfort, noise, and exposure to bad weather have also plagued these systems.

Recent efforts to upgrade the quality of service and to supplement the automobile include computerized matching carpool programs, subscription bus service, and demand responsive systems such as dial-a-ride. Demand responsive transportation refers to the flexible routing and scheduling of small units that operate door-to-door, or door-to-other transit stop by telephone request (Figure 36). Usually the modest fares do not reflect the operating cost of such a system and most of those in North America are operating at a loss (but then, so are nearly all public transit systems; Table 33). The average costs per passenger vary substantially from $2.48 in Haddonfield, New Jersey, to $0.60 in Bay Ridges, Ontario. The principal difference lies not so much in vehicle costs as in drivers' salaries, with unionization the principal factor that accounts for the increased costs. In San Diego, the ninth largest city in the country, the average salary of a bus driver is more than that of the mayor. With or without unionization, dial-a-ride systems will be expensive. However, many public bus systems have average passenger costs of over $1.00 per passenger, making the figures in Table 33 not unrea-

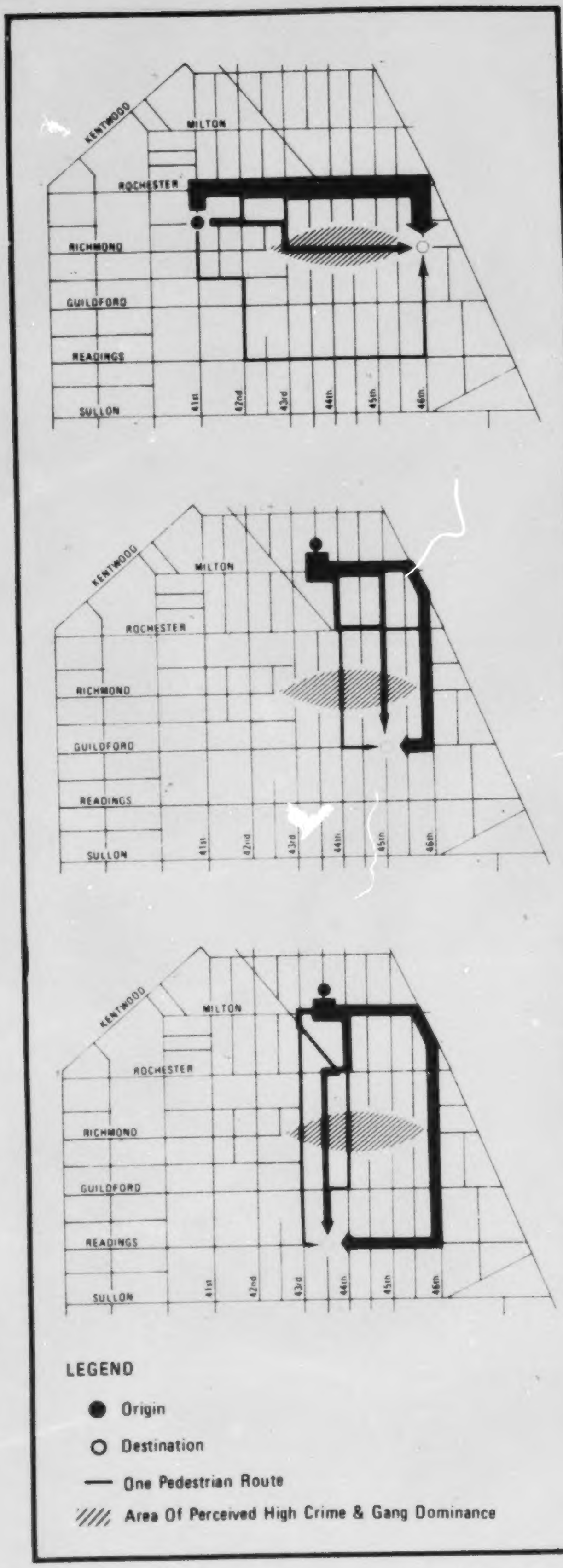


Figure 35. Graduated line segments show numbers of people and their path to a destination. Most would rather walk farther than to traverse an area of perceived danger because of street gangs (Modified from Ley, 1974).

TABLE 31. CITIES KNOWN TO HAVE REDUCED FARE PLANS FOR OLDER PERSONS

California:	Los Angeles San Diego San Francisco	New Mexico: New York:	Albuquerque Merrick New York
Connecticut:	Hartford Meriden New Haven Stamford	Ohio:	Ashtabula Cleveland Toledo
Illinois:	Chicago	Pennsylvania:	Philadelphia
Indiana:	Terre Haute	Rhode Island:	Pawtucket
Iowa:	Cedar Rapids Davenport Des Moines	Washington:	Seattle Tacoma
Massachusetts:	Boston	West Virginia:	Clarksburg
Michigan:	Detroit Flint Grand Rapids		

Source: Crain, 1973: Table 3.

sonable. Most public systems receive heavy subsidizations with almost half the states having public systems in early 1974. Demand responsive transportation systems in the United States as of May 1, 1974 occurred primarily in the urbanized states of the Northeast, Midwest, and Far West with few systems in the Deep South and in the Great Plains-Rocky Mountains states (Figure 37).

In demand responsive transportation several passengers can occupy one vehicle. The actual number of intermediate stops made before passengers reach their destinations will vary with the design of the operating network, the number of others waiting for service, the capacity of the vehicle, the time of day, and other such variables. There are several different types of service patterns (Figure 38). One is the route deviation form in which the vehicle deviates only slightly for pick up or drop off from the established trunk line. Another type is many-to-one, providing transit from several origins to a single destination, such as a shopping center or commuter train station. Many-to-few systems provide service between any origin-destination pair. Demand responsive transportation can perform certain services to the community, including a specialized door-to-door service for handicapped or elderly, a substitute for or alternative to the private automobile for the poor, a service in low density urban areas without transit, a service in rural regions, and a feeder service to major transit systems (Figure 39).

A Look at Some Programs

One of the most publicized demand responsive systems is the dial-a-ride project operating in Haddonfield,

TABLE 32. THE EFFECTS OF REDUCED TRANSIT FARES FOR THE ELDERLY

	Rates When Inaug.			Restrictions					%Change in Elderly Patronage		
	Sr. Citizen	Reg.	Date Inaug.	Age	Income	Mon.–Fri.	Sat.	Sun. & Holiday	Overall[a]	Reduced Fare Hours[b]	Change in Revenue[c]
Albuquerque, NM Transit System	20¢	30¢	10/—/68	65	None	—All Hours—			23%	23%	−18%
Torrance, CA Transit System	10¢	35¢	11/7/70	60	None	—All Hours—			30%	30%	−63%
Chicago, IL Transit Authority	20¢	40¢	4/20/69	65	None	-9am–3pm		7am–Midn.		14% to 39%	
Los Angeles, CA Southern CA RTD	15¢	22½¢	—/—/61	Men–65 Women–62	Same as Social Security	-9am–3pm -7pm Midn.		5am–Midn.	24%	40%	−11%
New York, NY City Transit Authority	10¢	20¢	5/14/79	65	None	10am–4pm 7pm–Midn.	—All Hours—			27%	−37%
Pittsburgh, PA Port Authority of Allegheny Co.	19¢	34¢	2/1/70	65	None	10am–3pm After 7pm	—All Hours—		21%	34%	−28%
Washington, DC DC Transit System	25¢	40¢	5/10/71	65	None	9:30am–3pm After 7pm	Not Good	All Hours	19%		−22%

[a] New rides/all former rides.

[b] New rides/former rides during reduced fare period.

[c] Calculated from $\frac{e}{E}(1 + \frac{\Delta b}{b + \Delta p}) - 1$. For Alburquerque and Torrance, $\Delta p = 0$; for Los Angeles and Pittsburgh, all data were supplied; for New York, the experimenters felt that Δp was close to zero, so it was assumed; and for Washington this was calculated from the daily dollar loss reported.

Source: Department of Transportation, 1973.

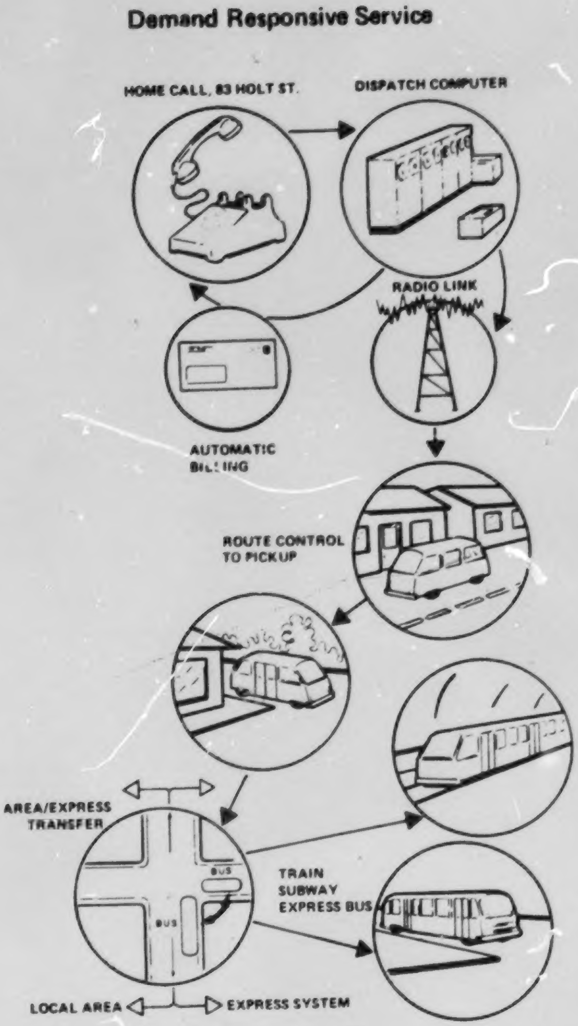


Figure 36. From Department of Transportation, 1974: 2.

New Jersey. It provides door-to-door service, 24 hours a day, seven days a week. Senior citizens may buy a ten-ride book for $4. The radio-equipped minibuses can carry 17 passengers. Early evaluation shows that 17 percent of the riders are over age 65. Dial-a-ride recently was started in La Habra, California, where the minibuses run every day except Sunday, from 7:00 a.m. to 7:00 p.m. Ten rides cost $3.50. Pickering, Ontario; Ann Arbor, Michigan; Rochester, New York; Columbus, Ohio; Long Island, New York; and Regina, Saskatchewan also use the dial-a-ride concept.

In June 1973 San Diego Yellow Cabs, Inc. inaugurated a dial-a-ride project in the suburban City of La Mesa with revenue sharing funds from the Federal government. All trips originate and terminate within the city. The service operates five days a week, 7:00 a.m. to 7:00 p.m., holidays excepted. Ten one-way tickets sell for $3.50. Yellow Cabs provide vehicles, operate the system, and provide all needed personnel and equipment at a cost to the City of La Mesa of $12 per hour per vehicle. The city receives the fares collected from passengers. Although the service is available to persons of all ages, older persons find it particularly attractive.

Minibuses are being used in other ways. In Peoria, Illinois, and Flint, Michigan, it is possible to buy a monthly subscription for transportation from home to factory and then back again. In Columbia, Maryland, and Mansfield, Ohio, a fixed route is followed with detours to pick up and deliver passengers. The Rapid Transit District now operates a minibus service in downtown Los Angeles for all age groups. The Model Neighborhood Program also operates a Federally funded minibus service. East Los Angeles is in the process of setting up a bus service for seniors.

Dade County, Florida, is establishing a transportation system for the elderly. When it is fully operational, it will consist of five ten-twelve passenger vans, three of which will be adapted to accommodate wheelchairs. Drivers will have training in first aid and will be briefed on the special needs of elderly passengers. Many transportation systems for the elderly are privately sponsored

TABLE 33. SYSTEM PERFORMANCE

	Average Daily Patronage	Passengers/ Vehicle Hour	Average Service Demands/Square Mile/Hour	Average Cost/ Vehicle Hour	Average Cost/ Passenger
Ann Arbor, Michigan	200	6.0	7	$14.60	$1.74
Batavia, New York	340	13.0	6	$12.50	$0.92
Bay Ridges, Ontario	700	17.0	30	$8.45	$0.60
Columbus, Ohio	355	8.4	9	$16.06	$1.53
Haddonfield, New Jersey	730	6.1	4	$15.40	$2.48
Regina, Sakatchewan	2,000	20	21	$13.43	$0.71

Source: Roos, 1974: Table 2.

DEMAND RESPONSIVE TRANSPORTATION SERVICES OPERATING IN 22 STATES, MAY 1, 1974

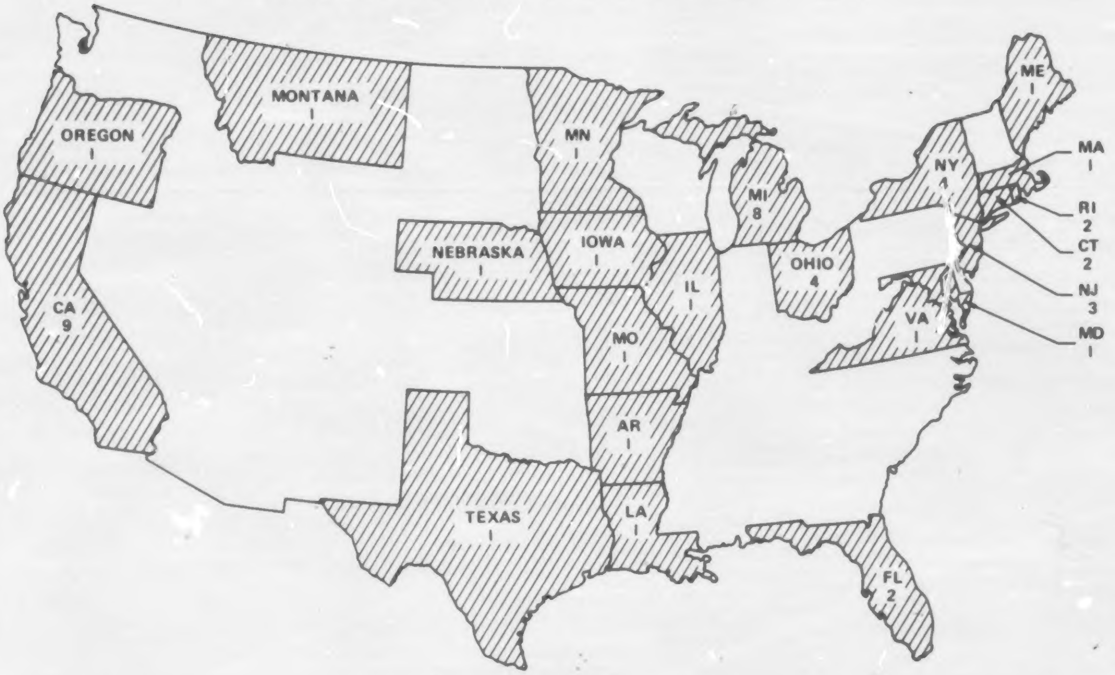


Figure 37. From Department of Transportation, 1974: 35.

or are joint ventures of local governments and nonprofit organizations. For example, the St. Clair County Council on Aging, a private nonprofit agency, has joined with the City of Port Huron, Michigan, to provide transportation service for the elderly. City appropriations cover the cost of two radio-equipped vehicles, a radio base station, fuel, insurance, and maintenance and repairs. The St. Clair Community Council on Aging operates the project; it recruits unpaid volunteer drivers, receives requests for service, dispatches cars, keeps records, and makes reports. The service operates daily except Sunday. No charge is made to retired city residents over age sixty. Those who wish may send contributions to the agency office.

In Washington, D.C., the American Red Cross provides transportation for the elderly on a limited basis. The United States Park Service provides transportation for the elderly to parks and other recreational areas. The Jewish Social Service Agency of Greater Washington operates a bus for the area's 8,000 elderly Jewish poor. Under a pilot program paid for by Arlington County, Virginia, and the Federal government, elderly persons in south Arlington are transported by taxis to county-sponsored events for a 15-cent ticket per ride. The balance of the $2.50 fare comes from a $46,000 fund, two-thirds of which is a Federal grant. A similar demonstration project is underway in Helena, Montana.

The Greater Indianapolis Progress Committee Task Force on Aging is working on plans for car pools for senior citizens, and on insurance for those transporting senior citizens in car pools. The Inquisitors Club is a private organization in Seattle, Washington that provides transportation for the elderly and handicapped. Founded in 1969, it now has over 15,000 active members. This nonprofit organization owns seven intercity buses, two school buses, and five twelve-passenger vans with radio dispatch equipment. One of the intercity buses has an electric hoist for wheelchairs. Members can purchase many different kinds of trips, including group trips to grocery stores, shopping centers, churches, and places of recreation and entertainment. Shuttle bus service is available during the week to any place in Seattle, and group sightseeing tours are scheduled throughout the Pacific Northwest and around the country. Activities of the club are supported by fares, the annual membership dues of $1, donations, and short-term loans. The club provides free minibus service for homebound Seattle elderly, funded in part through Project Mainstay (Title III, Older Americans Act).

A number of special transportation projects for the elderly currently are operating in Chicago. These are door-to-door demand actuated systems which take individuals and groups to a variety of destinations including shopping centers, medical facilities, and recreational activities. Among agencies operating transportation projects are the Council for Jewish Elderly, Mutual Enterprises for the Handicapped, Hull House Association, YMCA Seniors on the Move, and Little Brothers of the Poor. The Mayor's Office for Senior Citizens does not directly operate this type of transportation service, but

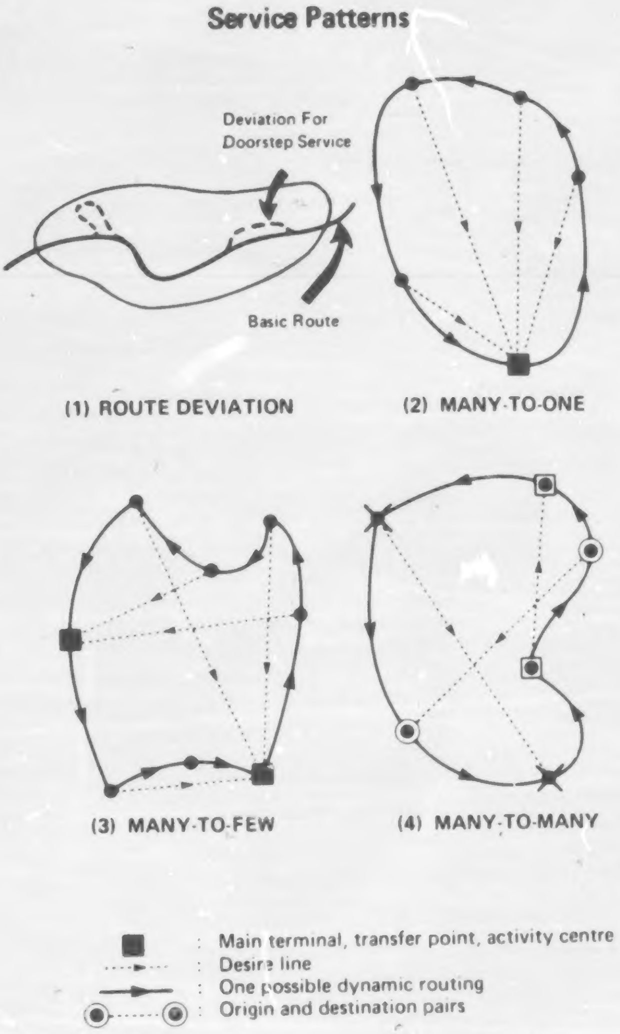

Service Patterns
Deviation For Doorstep Service
Basic Route
(1) ROUTE DEVIATION
(2) MANY-TO-ONE
(3) MANY-TO-FEW
(4) MANY-TO-MANY
Main terminal, transfer point, activity centre
Desire line
One possible dynamic routing
Origin and destination pairs

Figure 38. From Department of Transportation, 1974: 3.

uses purchase of service contracts with the YMCA and the Little Brothers of the Poor. Senior citizen groups and clubs may rent a bus for half price under a program operated by the Mayor's Office for Senior Citizens; they can use the bus for trips to museums, theaters, and special events. The cost per bus is $22.50. The requirements are: 1) trip destinations must be within the Chicago city limits; 2) no more than two buses may be reserved for one trip; 3) no more than 45 persons can ride on one bus; 4) one supervisor must be provided for every twenty people being transported; 5) buses may be reserved three weeks in advance of the planned trip.

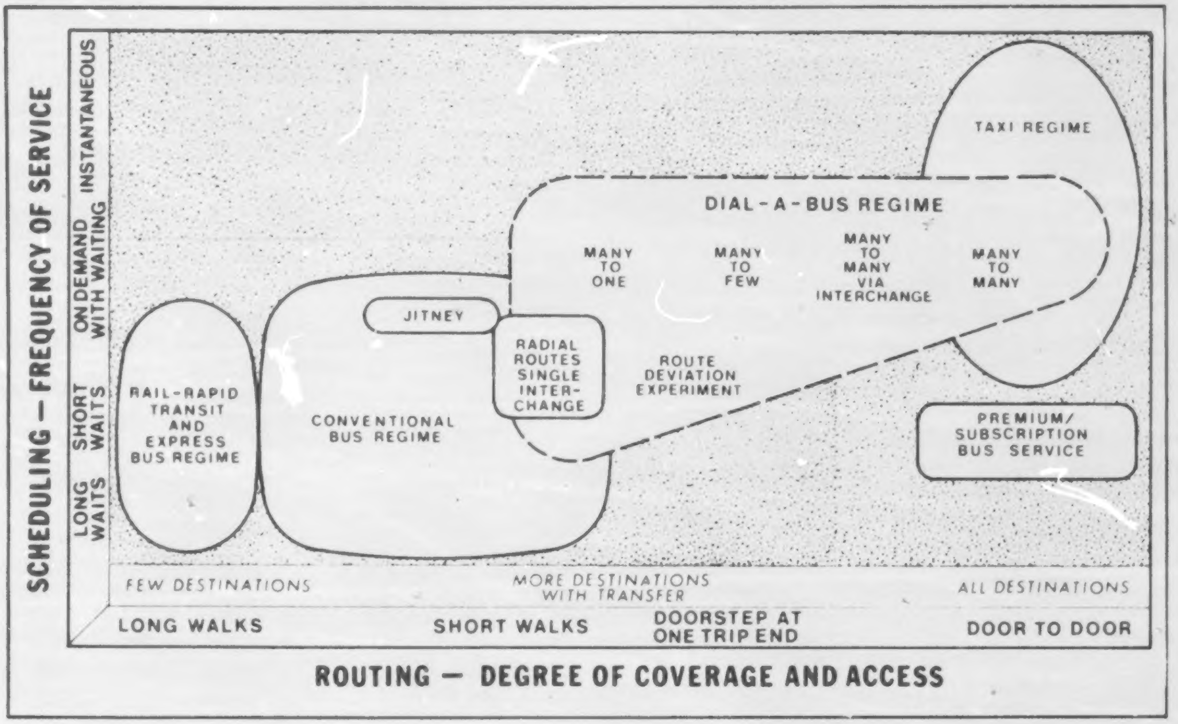
The City of Chicago is seeking a grant from the Urban Mass Transportation Administration to establish a special transportation system for the elderly and handicapped. One of the goals of this project is to develop a coordinating mechanism which will ensure that the various special transportation systems are working together and that all the services are functioning at an efficient level. Some social service agencies provide elderly clients with workers who perform multiple functions such as cleaning the house, preparing meals, shopping, and providing transportation as required. There are many kinds of individual arrangements by older people for their transportation, and this is a topic that should be studied.

Infirm and handicapped persons often cannot use public transportation, although there is increasing attention to their needs. Not only are there difficulties in getting on and off the bus, but there is the problem of maintaining balance until one finds a seat, holding on to an overhead grasp, and moving quickly to an exit door. Nonetheless, the aged will benefit from the increased emphasis on public transportation, which is being spurred by fuel shortages, air pollution, and freeway congestion.

Conclusions and Policy Recommendations

Falcocchio *et al.*'s (1972) study of nonwork travel characteristics of model cities residents in Brooklyn found that the requirements and preferences of the residents are much the same as they are for the remainder of the population. These poor people were hampered by the fact that most did not own automobiles and that they were victims of the local mass transit. The authors' recommendations suggested for this area included 1) elimination of multiple zone fares, 2) increasing off-peak transit service along heavily traveled routes, 3) allowing groups riding in taxis a reduced total fare, 4) concentration of new services on major corridors of demand, for example, from high density areas to suburban job locations, shopping areas and recreational centers, and major hospitals, and 5) improvement of the coordination of inter- and intramodal transportation interfacing, especially at off-peak hours. If improved public transportation can reduce unemployment, it appears that public subsidies will be necessary. Such van pooling or minibus routes serving pickup locations to jobs cannot operate on fares alone. Moreover, these programs are socially and economically justified as they not only give the individual self-respect but they also reduce the total costs of public subsidies to the unskilled worker through unemployment and welfare compensation.

More efficient use of automobiles can come about through new "Commuter Computer" carpool matching service. By dialing the number 234-POOL, in San Diego, for example, a local city computer will mail free of charge a list of people with similar schedules and locations. Express buses on expressways can entice individuals away from reliance on the private automobile as a primary mode of transportation. In some cases there is adequate room in the road median for exclusive bus lanes (Figure 40). Local community-scale transit service can complement the above system and act as a "feeder" to it. It should include the use of minibuses and dial-a-ride systems which give special attention to the elderly and handicapped. A network of bicycle lanes across the city and into the rural areas should be built to encourage this type of transportation, especially for the youth. Cycling to work is a distinct possibility. Transit vehicles should be able to carry cycles so the cyclist can extend



CONCEPTUAL FRAMEWORK FOR DIAL-A-BUS SERVICES

SCHEDULING — FREQUENCY OF SERVICE
INSTANTANEOUS
ON DEMAND WITH WAITING
SHORT WAITS
LONG WAITS
TAXI REGIME
DIAL - A - BUS REGIME
MANY TO ONE
MANY TO FEW
MANY TO MANY VIA INTERCHANGE
MANY TO MANY
JITNEY
RADIAL ROUTES SINGLE INTER-CHANGE
ROUTE DEVIATION EXPERIMENT
RAIL-RAPID TRANSIT AND EXPRESS BUS REGIME
CONVENTIONAL BUS REGIME
PREMIUM/ SUBSCRIPTION BUS SERVICE
FEW DESTINATIONS
MORE DESTINATIONS WITH TRANSFER
ALL DESTINATIONS
LONG WALKS
SHORT WALKS
DOORSTEP AT ONE TRIP END
DOOR TO DOOR
ROUTING — DEGREE OF COVERAGE AND ACCESS

Figure 39. From Department of Transportation, 1974: 21.

his range. Presently a bicycle-bus program is operating in San Diego on an experimental basis.

The Federal government has recognized the need to aid elderly and handicapped in meeting their transportation requirements. In a 1970 amendment to the Urban Mass Transportation Act, Congress stated that: "It is hereby declared to be the national policy that the elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services." Later, in 1973, the Older Americans Comprehensive Services Amendments provided funding for study and demonstration projects related to transportation. The amendments directed the Commissioner on Aging to conduct a study that would emphasize new alternatives which can be put into use in the near future. The Commissioner was to cooperate with the Department of Transportation first, and then with the Department of Housing and Urban Development, in order to give special attention to the manner in which present and future public transit could be made to serve the elderly and handicapped. In 1973, also, Congress amended the Federal Aid Highway Act to allow states to use part of the funding that previously had been used exclusively for highways. The Act included three elements of special importance to the problems of transportation for the elderly and handicapped. It 1) required that public transit vehicles that were being financed by Federal dollars be designed and built with special features to aid elderly and handicapped in using such vehicles; 2) allowed grants and loans to private nonprofit organizations such as churches or medical centers to develop and use transit for these special groups; and 3) allowed for rural highway demonstration programs that would bring public transportation to these areas.

Local jurisdictions are also creating programs around

EXCLUSIVE BUS LANES

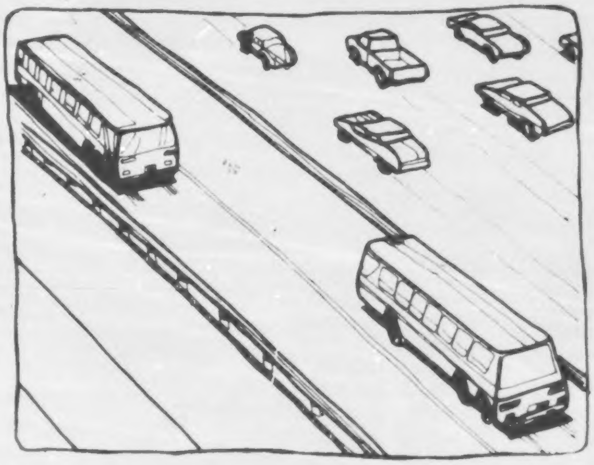


Figure 40. Express bus lanes can occupy an expressway median such as pictured here, or a special unseparated lane of regular traffic.

the country to aid the transportation disadvantaged. The Technical Advisory Committee to the San Francisco Office of the Aging made a number of recommendations for the area on transportation for elderly and handicapped in a report issued April 1, 1974. Recommendations that may be applicable to many cities are: 1) bus drivers should be given special training in safe operating procedures with elderly and handicapped passengers; 2) transit system buses should be made available for organized outings and for transporting the elderly to various service agencies; 3) the requirements of the aged and handicapped should be considered in purchasing new buses and in modifying those already operating, i.e., components such as steps, seats, and stanchions should be redesigned to insure greater safety; and 4) benches should be provided at major transfer points used by older people, such as near hospitals and senior recreation centers.

Rural areas are just now being recognized as areas of public transportation need. McKelvey and Dueker's (1974) experimental project in Iowa to implement a rural dial-a-ride system, identifies some of the problems of such initial projects and outlines certain policy considerations: 1) the planning of such systems must be comprehensive and must involve the elderly and the handicapped that the system is attempting to serve; 2) political leaders and social agencies must be included in the project if it is to gain any level of success; 3) door-to-door operation and service is essential for most elderly and handicapped; 4) promotion of the program through public information channels is necessary and such programs should include such techniques as memberships, reasonable fares, and an easily used dialing system to reduce psychological friction; 5) there should be service available for all trip types for rural disadvantaged as well as all others; and 6) a level of funding commitment on the part of the state, county or Federal government must be made prior to initiation of the project.

It is the disadvantaged, both rural and urban, that suffer the most from negative transportation impacts—reduced access, displacements, noise and air pollution. Transportation is less available to disadvantaged groups who rely heavily on walking. Traffic is the greatest barrier to the unassisted movement of the disadvantaged. The elderly and poor are particularly dependent upon walking for economic reasons generally.

IV. SOCIAL IMPACTS OF TRANSPORTATION

A community and its residents are responsible for most of the negative social consequences of transportation systems. This chapter will emphasize the recent social impacts that transportation rights-of-way have on residents of the area to be affected by the improvement, on the communities in which they live, and on the associated landscape. These rights-of-way include land to be used primarily for highways, but to a smaller degree, for rapid transit lines, railroads, airports, and power transmission lines. The impacts from transportation can be positive as well as negative, social as well as economic. Given the impact studies in the book, *Studies of Highway Development and Geographic Change,* by Garrison and his students (1959), it is surprising that there has been little work by geographers on these topics.

Some of the social and economic impacts that have been studied include problems of the displacement of residents from their communities, displacement of businesses, proximity effects of freeways, and community disruption. For example, relocated residents may receive monetary compensation and may find satisfactory new housing. Yet, they may suffer social disruption. Those left behind near the new transportation facility may suffer from noise, air pollution, safety hazards, and community access problems, some of which may be reflected in land values. Other types of access changes may be positive even for residential land, in reducing travel times to major services and work locations. Industrial and commercial land uses benefit more from highway proximity than do residential land uses. In general the problems of negative impacts from proximity to transportation rights-of-way have resulted from a lack of planning that produces poor land use compatability. Improved land use planning and zoning control near transportation rights-of-way should help reduce future conflicts.

Some community approaches and route location procedures have been developed that increase objectivity in decision making, and these will be reviewed subsequently. But for the most part, there have been few breakthroughs in dealing with social and even economic impacts, although concerned citizens' groups and conservation organizations are better organized than ever before. Sometimes, the very representation of the Sierra Club or the NAACP is enough to tip the scales in their favor. Precise information is missing and that which is available is seldom quantifiable. Present analysis is inadequate because, unlike engineering costs and user (traveler) benefits, social and environmental effects of transportation improvements cannot be weighed. Although we can describe present effects and forecast future effects of the impact of a new urban expressway on a neighborhood's stability, we cannot give precise formulas that handle the relationship among the variables. Transportation advocates argue that these social and aesthetic problems should be handled later, while community advocates work for a court restraining order or law suit (Mumphrey, 1975). Present-day legal machinery is such that the wishes of only a few can prevail, causing extreme inefficiency in already expended human and natural resources. The study of Chicago's Crosstown Expressway demonstrates this dilemma. Social costs were found to be substantially different from engineering costs, and affected the final route location (Pavlos, 1975). But possibly more important was the inefficiency of the political process itself. The action of citizen groups in the decision making had the effect of not allowing any decision to be made. The minority's rights were protected under law, thus disallowing the wider interest of the remaining majority.

Displacements

Residents and businesses that are located in planned rights-of-way are frequently displaced from their respective communities and this forced move can be socially, psychologically, as well as economically disruptive and harmful. The law requires transportation agencies to pay for relocation costs of residents into structurally sound and sanitary housing with full utilities and plumbing. In some cases, this new housing may be better than that left behind. Besides compensating for the value of the house, homeowners are allowed up to $15,000, whereas renters are entitled to up to $4,000 for extra costs that they might face with a change in housing. Actual costs over and above housing reimbursement averaged $2,600 for the 8,000 homeowners relocated in 1972, and $1,000 for the 7,500 renters moved. For 1973 the increased payments averaged $4,800 for homeowners (DOT, 1974). In spite of this apparently fair monetary compensation, relocatees have no choice about whether or not to move. When they are moved, they may be separated from friends, relatives, work, shops, and other personal and social necessities. Small businesses face even greater losses, since their owners' means of livelihood, perhaps even life investments, are risked in the process of a difficult move. The law may provide monetary compensation to help facilitate the move, but this is sometimes insufficient to cover the hidden costs. How can you compensate the loss of social networks or the loss of a sense of community? The disadvantaged, particularly the elderly, are hard hit by relocation. New facilities seem to strike older areas of town most frequently because they are close to the city's center which the new facility must serve. For the elderly, personal friendships are one of the most important aspects of day-to-day life. Loss of familiar faces and the change in occupied areas of the city may cause increased pathology and the need for more medical attention in relocated groups.

Two case studies dealing with people displaced from highway rights-of-way can be instructive. The first study examined problems of 250 Cleveland residents after a 1972 relocation brought on by highway construction (Colony, 1970). These people were, on the average, lower income, predominantly white residents with just over half owning their homes. After relocation most purchased homes costing more than their old ones and the level of home ownership rose substantially. About 24 percent experienced longer work trips, whereas 13 percent had shorter work trips. Shopping trips were almost unaffected in length, although the destinations of the trips changed. Negative attitudes about the relocation were expressed by sixty percent of the relocatees at the outset, and two years after 36 percent still had overall negative attitudes about the relocation. Those negative attitudes centered around the inconvenience of moving a household, the loss of contact with old neighborhood acquaintances and places, higher interest rates on new mortgages, and the timing of relocation payments. One sociopsychological measure was used in an attitude test before the project began, and it rated the respondents' state of mind concerning their outlook on society in general. Colony points out that those relocatees with high alienation scores on the test were much more likely to report negative attitudes about their new physical setting, suggesting that their displeasure with the relocation may have been fostered partly by feelings about themselves and their role in society.

The second study performed at Texas A & M University in 1973 dealt with 171 relocatees from highway building in the Austin and Houston areas. Of the group, about half were white, a third black, and the remaining were Mexican-American. Three-fourths of the group were employed. Forty percent upgraded their housing and most of the remainder moved to comparable housing. The relocatees for the most part (93 percent) increased their net worth, but transportation and utility costs averaged $8 per month more after relocation. More reported that they were worse off financially (38 percent) than those reporting that they were better off (22 percent). Similar to the Cleveland study discussed above, 65 percent of the relocatees in this Texas study were initially negative about the relocation process, but later only 23 percent had continuing negative feelings. From these studies, it is apparent that transportation agencies are attempting to make a "fair" adjustment to those experiencing relocation. Just as punitive damages in an insurance adjustment are frequently not calculated nor compensated for (but recently have begun to be), so are most social costs of highway relocation ignored.

Proximity Effects on Residential Property

One problem in locating rights-of-way is that although some land parcels near the transportation improvement are adversely affected by noise, air pollution, and congestion, because they are not within the right-of-way, they are not compensated. Several studies using attitude survey sampling of residents near new facilities indicate that air pollution, congestion, safety of children, and, especially, uncontrolled noise, are important problems. Adverse noise levels range from fifty to ninety decibels, with the United States community noise level standards (CNEL) set at a maximum of 65 decibels. One study performed in Louisville, Kentucky, by Sharpe and Maxman (1972), analyzed 2,000 questionnaires to identify the principal negative sources of an urban arterial corridor. The study revealed that noise, air pollution, and pedestrian safety, in that order, were the most severe problems. Another study conducted by Opinion Research Corporation (1971) asked a similar question to over 2,000 adults selected in a manner to allow expansion to the United States population as a whole. The results were identical to those of Sharpe and Maxman listed above. In addition, a few residents reported loss of neighborhood stores, lower home values, or loss of contacts with friends, and others mentioned problems that included changes in neighborhood character, dust in homes, and odors. Another study by Texas A & M University (1971) showed that residents' evaluations of urban freeways became more positive with decreasing roadway elevation. Those areas in which the freeway was depressed below the ground level got the highest evaluations, whereas the areas where it was elevated got the lowest evaluations. In a survey of 550 households in Milwaukee near the proposed Stadium Freeway, Ryan *et al.* (1972) found that within 500 feet, 73 percent opposed the freeway; within 501 to 1,100 feet, 56 percent opposed it; and within 1,101 to 5,000 feet, only forty percent opposed it. In addition to proximity effects they also found socioeconomic ones as well. Seventy-four percent of those over seventy opposed it, 65 percent of those with less than a high school education opposed it, and 65 percent of those families earning less than $5,200 a year opposed it.

Mumphrey and Wolpert (1973) developed a graphic utility model showing these areas of positive and negative impacts discussed above. In their case, the question was the siting of a new bridge across the Mississippi River at New Orleans. The areas of positive and negative impacts are the circles centered at the two alternative bridge sites (Figure 41). They used the model to suggest the expected voter referenda outcomes by examining the location of voters vis-a-vis the spatial equity of the siting (Figure 41). Voters located between a' and e' will vote for a bridge at location 1, because the net benefits (marginal benefits minus marginal costs) are larger for them by having the bridge at location 1. At e' the voters are indifferent. From e' to c' they vote for location 2, and from c' to f' they favor location 1. At f' and c' they are indifferent and from f' to j' they favor location 2.

Negative effects usually decline with distance away from the transportation right-of-way until they are all but negligible. A Pennsylvania State University study (1973) showed that land values at every location near a freeway increased because of increasing regional accessibility provided by the freeway (I-495). This is more than enough to offset the negative proximity effects reflected in land values. Appleyard and Lintell (1971) studied impacts in San Francisco from local streets rather than

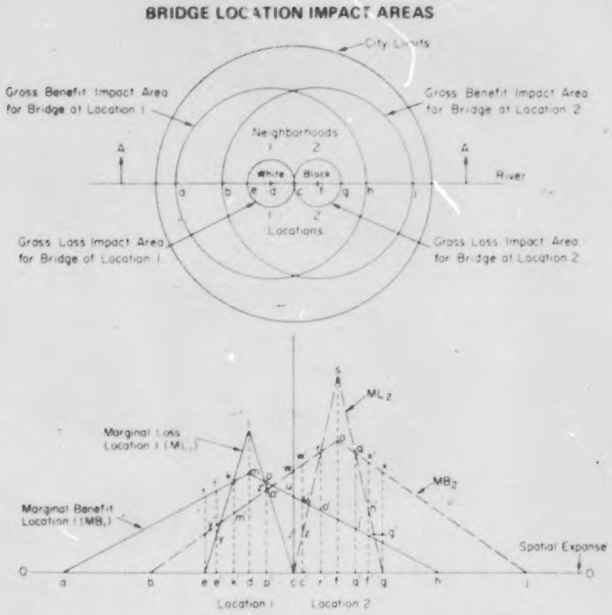

BRIDGE LOCATION IMPACT AREAS
City Limits
Gross Benefit Impact Area for Bridge at Location 1
Gross Benefit Impact Area for Bridge at Location 2
Neighborhoods
1
2
A
A
White
Black
River
a
b
e
d
c
f
g
h
i
1
2
Locations
Gross Loss Impact Area for Bridge at Location 1
Gross Loss Impact Area for Bridge at Location 2
s
ML2
Marginal Loss Location 1 (ML1)
MB2
Marginal Benefit Location 1 (MB1)
Spatial Expanse
0
0
a
b
e
e
k
d
p
c
c
r
f
q
f
g
h
i
Location 1
Location 2

Figure 41. The top diagram shows the locations possible for a new bridge crossing the Mississippi River at New Orleans and the associated impact areas. The bottom diagram is a cross-section of the top diagram, showing the territories of marginal loss and benefit as intersecting tents mirroring the impact circles at top (Mumphrey and Wolpert, 1973: 112-113).

from expressways, and found that a street with heavy traffic (16,000 vehicles per day and 1,900 during the peak hour, with cars traveling 35 to forty miles per hour) caused stress to the residents. Here the housing turnover was greater and people lived in the rear of their homes, rarely using the front yards. On streets with light traffic (2,000 vehicles per day and 200 during the peak hour, going 15 to twenty miles per hour) residents had a positive attitude toward the street and used it more heavily.

In Colony's (1973) study involving the effects of residential proximity to freeways, he had professional real estate salesmen in Toledo estimate the values of residential property, the backyards of which abutted an expressway. They estimated homes generally to be twenty percent cheaper than others not abutting expressways. However, Colony showed that homes in a large tract next to the expressway in Toledo sold at the same rate as did those in the same tract which were removed from the expressway, but they were usually selected last. The author did not review the general nature of the housing market in the area at the time of the study. In many cities today, any new home can be sold, regardless of the location, if the city is experiencing a housing shortage.

Impacts on Community Schools, Churches, and Hospitals

Schools, churches, and hospitals are land uses thought to be most negatively affected by highway noise, air pollution, and congestion. For schools, the suitability of the location depends on a number of factors, such as the age of students attending, the number of students attending, the size of the school catchment area, and the degree to which the community uses the school for other than normal school sessions. Generally, elementary schools have a large group of students who walk to class, and small catchment areas. Here, noise from an expressway or major arterial can have harmful effects. With high schools, the student body size is larger, as are the catchment areas because high schools must take advantage of scale economies in order to provide more expensive educational facilities. In this case, a major traffic arterial or even an expressway can be beneficial by improving the access needs of more people. Older students are less distracted by noise, and with a larger plant, athletic fields, gyms, and other grounds and buildings can be used to buffer the noise (Figure 42). High schools placed in a neighborhood with low capacity (1,000 to 3,000 vehicles per day) streets can create a strong negative and stressful effect on the residents. One high school in San Diego is a case in point. In this city, rapid growth has overtaxed the capacity of every suburban high school. Patrick Henry High School, located in the eastern suburb of San Carlos, was designed for 2,500 students (Figure 42) and was located on an intermediate level arterial to provide access. At

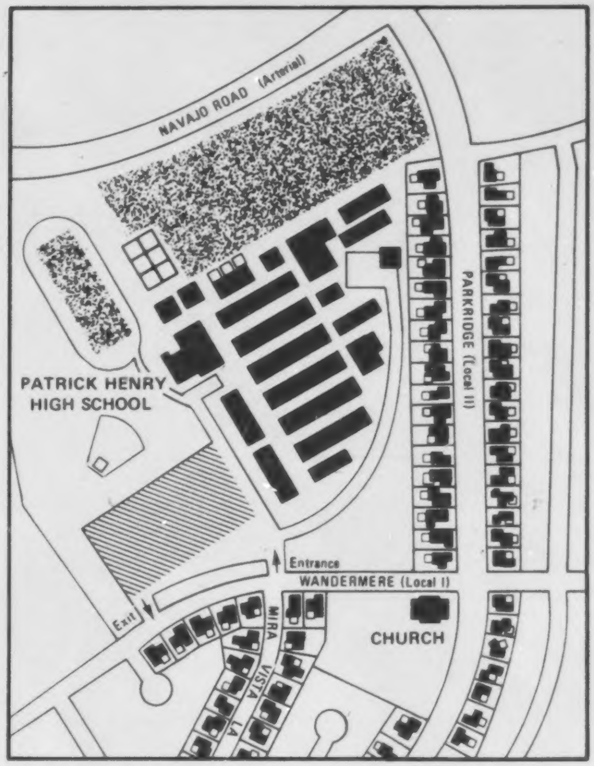

NAVAJO ROAD (Arterial)
PATRICK HENRY HIGH SCHOOL
PARKRIDGE (Local II)
Entrance
WANDERMERE (Local I)
Exit
MIRA
VISTA
LA
CHURCH

Figure 42. Schools can buffer the noise impact from an arterial by placing play fields between the classrooms and the arterial. However, as in the case shown above, if the school uses the local street (Wandermere) rather than the arterial (Navajo) for access, the neighborhood will be subject to noise and traffic.

the last minute the entrance was opened to the school using a local neighborhood street because the football coach was afraid the proposed entrance would disturb access to the field. Within three years the high school had forty temporary classrooms on its parking lot and the school enrollment had risen to over 4,000. The high school was located in a middle-to-upper-class community and many of the students owned cars and motorcycles. Some were also bused in from the inner city. The local street was now the scene of an almost constant stream of automobiles, buses, and motorcycles. Values of homes abutting the school were approximately eight percent lower than those not facing the school. Housing turnover was also greater in the affected areas. Next, the city decided to use the outdoor theater facility for summer operettas catering to a wide area of the city. With the expectation of even more traffic continuing into the evening, the local community fought and finally blocked the action.

Traditionally churches have sought a quiet, pedestrian oriented location, and churches still gravitate to these locations, especially if they are local, community churches. Churches are more and more drawing their constituencies from increasingly larger areas and many are better classified as community-wide churches (Sopher, 1967; Stutz and Hinshaw, 1976). These churches desire accessible, visible locations. A study of church location along the Capital Beltway around Washington, D.C. examined 35 churches and found that 21 of these thought the beltway was favorable (Neuman, 1968). Hospitals also receive positive and negative impacts from transportation routes. "Quiet zones" have been established around some hospitals. However, the visibility and access afforded by a freeway usually dictates their location, regardless of noise problems. Most hospitals compete with one another and a location on the freeway will elongate their service areas. In San Diego, a center for medical technology and development, most hospitals are below capacity and some are operating at a loss. The city currently has an excess of hospitals. All but four of the twenty major hospitals are visible from the freeway system. Morrill *et al.* (1970) show in Chicago studies that medical facilities are located with respect to threshold and accessibility. Because most people select a hospital as a result of their physician's staff affiliation, the Morrill study shows that religious, ethnic, and socioeconomic status can limit patients' choices and relegate them to a third-class system of medical care.

Commercial and Industrial Impacts

In general, business and industry can easily absorb the negative social impacts of rights-of-way and can benefit from their positive economic effects. Businesses may be harmed by highways if access is cut off to customers. However, businesses prefer to be near highways to be in view of traffic, or for the improved access from it. Industrial locations typically favor proximity as well as accessibility. A survey by Connally (1968) of 54 firms located near I-495 in Virginia, lists proximity to highways and access to local markets as the most important locational factors (Table 34). An earlier study by Garrison *et al.* (1959) examined the effects on businesses in Marysville, Washington, when highway traffic was diverted to what is now I-5 running between Mt. Vernon and Everett. The major proximity effect on the small town was decreased congestion through the town, making Marysville a more pleasant place to live. Home construction rose and town access for lower order goods increased, as did business for this level of shopping. Everett also became more accessible and was now used for higher order goods more than was the case under pre-highway conditions.

Although development near a new expressway favors primarily industrial and wholesale businesses, and to a lesser degree retail and services, development near rapid transit lines favors primarily retail and service businesses and residential land uses. San Francisco's Bay Area Rapid Transit (BART) system is a recent example of enormous development around transit stations. Retail business has climbed in these areas, and there has been a major jump in land values, calling for more intensive development. The most dramatic development has come in certain eastern counties, around Walnut Creek and Concord, where prior to BART there was only rural land. The threat of higher taxes was the most important negative effect anticipated by the system (Table 35). (Fears were justified when a sales tax override was instituted in the counties served by BART). Other negative effects included more development, especially of apartments and parking lots around stations, and less open space. Positive effects were also noted (Table 36).

Community Impacts

Although internal transportation within communities, especially social visiting, can increase neighborhood cohesion and strengthen a community, substantial through traffic has been shown in Appleyard and Lin-

TABLE 34. REASONS GIVEN FOR SITE SELECTION BY SAMPLE OF 54 FIRMS LOCATED ALONG THE CAPITAL BELTWAY IN VIRGINIA

Reasons	Number of Times Mentioned*
**Proximity to Highways	33
**Access to Local Markets and Clients	26
**Price of Land	14
Availability of a Large Land Parcel	11
Amenities	7
Availability of Rail Siding	6
**Access to a Larger Labor Market	5
Availability of Leasable Property	5
**Convenience to Existing Employees	4
**Advertising Value of New Site	2
Availability of Raw Materials on Site	2
Possibility to Expand on Site	2
**Proximity to Airports	2

* Some respondents gave more than one reason.
** Factors related to highway accessibility.
Source: Connally, 1968.

TABLE 35. ANTICIPATED NEGATIVE EFFECTS OF BART

	Percent
Taxes go up	69
More apartment buildings	56
More parking lots, garages	47
Less open space	46
More stores	44
More high rises	42
Property bought by people with money	42
More offices and industry	38
More subdivisions	36
BART stations provide hiding places for "shady characters"	35
Stores will lose customers	34
Increased parking problems for residents	34
More salesmen	31
Danger of children, adults straying into BART tracks	28
More auto traffic	26
Danger of BART going off tracks	24
Homes up for sale	22
Undesirable people	21
More trash or litter on streets	18
More dirt or dust in air	14

N = 2,541; San Francisco Bay Area, 1972.
Source: Carp, 1974: 74.

tell's study of San Francisco, the San Diego high school example, and the study of Marysville, Washington, to have harmful effects on community cohesion. Highways especially disrupt community cohesion by increasing noise, dirt, and especially traffic congestion, thus creating physical and psychological constraints. Such congestion can lower the level of community services by restricting movement to them.

Community Case Studies

Several case studies of community conflict over highways illustrate a variety of responses to citizen demands. The first deals with the Philadelphia Crosstown Expressway which threatened a low-income black community. The expressway was planned as early as 1947, but it was not until 1965 that opposition arose. It was argued by the opposition that the precise location of the expressway, which was to be situated between the black ghetto and the white middle-class center city, was not adequately considered. The expressway would have eliminated many businesses along a principal commercial boulevard. External pressures by professional and community groups strengthened the opposition (Wolpert *et al.*, 1972). The citizens won their fight, but it was a matter of outside influence and events that enabled them to do so—professional planners and lawyers jumping on the bandwagon against the expressway, and pressure put on the mayor who was running for reelection. Nonetheless, the black residents abandoned the area because of their uncertainties about the expressway, and thus suffered a severe loss of community.

Another case showed community mobilization to protect a historical site from possible harmful effects of an expressway in New Orleans (Mumphrey, 1970). The Vieux Carré is the original site of New Orleans and is located along the Mississippi River just east of the central business district (Figure 43). Here old buildings with their abundant wrought iron work, left over from an earlier period, stand gracefully around Jackson Square. The Vieux Carré is also the site of the Mardi Gras festival, Bourbon Street, and the popular French Quarter. The State Highway Department planned to extend an expressway between Vieux Carré and the waterfront, and proposed several different alignments, including a depressed design. They felt that the new facility would decrease congestion on other routes, such as Canal Street, and would bring traffic into downtown. Community advocates thought that the excess noise and pollution would be harmful to the historic area. The community groups did all in their power to halt the action, including bringing suits against the Highway Department, conducting publicity campaigns with testimonials from city leaders discrediting the proposed expressway, submitting their own plans, and even appealing to the United States Secretary of Transportation. The opponents of the plan finally won after costly and lengthy delays in highway construction. But probably it was only because of the symbolism of the Vieux Carré and its perceived importance to the residents that enabled them to win. Alternate means to ease traffic were instigated instead, including exclusive bus lanes on Canal Street.

A final example of potential community disruption from highway interference is the case of Nashville, Tennessee. Anyone who has driven through Nashville on Highway 41 from St. Louis to Atlanta would have welcomed the completion of I-40. The trip was tedious and lengthy. The blacks who were to suffer neighborhood demise were totally unaware of the problem until it was almost too late (Wolpert *et al.*, 1972). The strategy used by the State Highway Department was purposely ambiguous in order to nullify any opposition. Apparently this approach worked well, given the political and educational system of this area. The residents hired a lawyer and a professional planner to act as their advocates, but the residents were too uninformed to aid them or to make demands on the job they were doing, other than to give them their blind support. Without strong

TABLE 36. ANTICIPATED POSITIVE EFFECTS OF BART

	Percent
Less traffic on freeways	65
Less air pollution/less cars on road	62
More pride in modern city	49
Better looking area	33
Quieter	28
More walks, exercise—enjoy outdoors more	24
Area safer than now	22
Better area for children to play	19
Neighbors—better place to get together	17

N = 2,541; San Francisco Bay Area, 1972.
Source: Carp, 1974: 74.

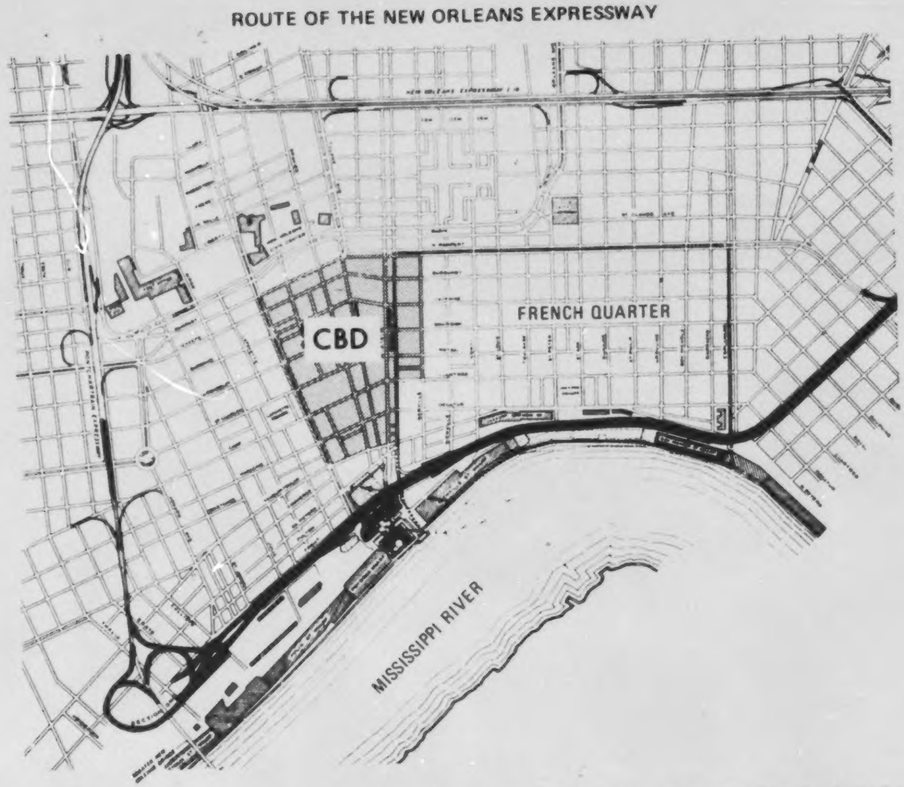


Figure 43. The Vieux Carré is the original site of New Orleans and is located within the dotted area labeled "French Quarter." The Riverfront Expressway through this area was halted by citizen action to save the historic site (Adapted from Mumphrey, 1970: 8).

community action and support, the planner was doomed to lose the fight. I-40 was completed through Nashville.

The principal difference among the three examples presented above was community solidarity and participation. Without it, community defenses are substantially weakened.

Community Social Indicators

If the impact of a highway on a community can be predicted before it is built, areas that will be harmed by the facility can be avoided in deference to those that will benefit from it. One approach at the estimation of community effects of highway impacts has involved examining the residential stability of an area (Hill, 1967). In this study the stability of a neighborhood was regarded as a measure of its strength. The oversimplified indicator consisted of the percent of 1) owner-occupied houses, 2) single family residences, and 3) households in the same dwelling over a five-year period. Burke (1970) experimented with this index using data from 99 neighborhoods in Austin, Dallas, and Houston. He developed a single variable index that gave the same results as the previous one which used three variables. This simple and less expensive index was calculated by the formula:

$$\text{Mobility Index MI} = 200 - 2^{R}$$

"R" was the percent of households living in the same dwelling over the last five years. Experiments showed that the index increased more in neighborhoods fragmented by highways than in others, suggesting that these neighborhoods were becoming less stable.

Another indicator used to measure neighborhood sensitivity to highways is the "level" of neighborhood pedestrian dependency" (Kaplan *et al.*, 1972). This indicator depends on the proportion of households with cars, the number of people per household, and the median household income. The higher the index value, the greater is the dependence on walking, and the more disruptive a freeway would be. To calculate a general pedestrian dependency one must add the above value to school, local shopping, and social institution pedestrian dependency levels. School pedestrian dependency is measured by the percent of school children in the local population. Local shopping pedestrian dependency is measured as the number of households without cars, the number of people per household, and the number of elderly. Social institution pedestrian dependency refers to the tendency of the group in question to walk to church, clubs, the library, and community centers. This model was used in locating I-290 across two neighborhoods in Worcester, Massachusetts. Both Worcester neighborhoods had high pedestrian dependency scores and they experienced major highway impacts on their activity pattern. Kaplan *et al.* (1972) stated that low density suburban neighborhoods, in which more of the community activities are located outside the neighborhood, have a greater tolerance for expressways than high density ones. Other neighborhoods indicators have been based on human response data (Sharpe and Williams, 1973) and give more promising results because they are based upon individual responses.

One's point of view can alter the estimation of what the neighborhood or community effects of a highway might be. One study by Bishop *et al.* (1970), conducted at Stanford, documented criteria for highway location according to various community groups (Table 37). Not surprising perhaps, was the fact that the 147 citizens and 164 officials and public employees interviewed said that avoiding neighborhoods was the most important criteria. Except for planners, who tended to be more idealistic, there was fairly close agreement in what the respondents thought were important criteria.

Mitigating Impacts Through Community Identification

One approach toward mitigating the problems associated with negative impacts of highways on communities is to identify the boundaries of communities so that facilities can be built around them. A community exists where behavorial and social relationships exist among its residents. These include interaction and social visiting, use of local facilities such as shops, schools, and parks, participation in local organizations, a high amount of pedestrianism, and positive attitudes toward community and identification with it. One researcher has dichotomized the concept of community into localized and nonlocalized units (Parsons, 1951). Localized communities incorporate individuals who are interested in policy making and who identify with the social system of families who reside in the area. Localized communities have a strongly developed sense of place. According to Kaufman (1959), there are strong and weak communities. Strong communities have actions locally oriented across the entire range of human interests, and these actions are integrated through an ideology. Weak communities are those that have lost or never had many of these locally oriented actions and services and have declined as interaction units.

There is some evidence to suggest that social travel fields demarcate communities (Stutz, 1973a). In this study, Stutz used only social trips. In another study, he used all nonwork trips between and among census tracts, as these are a better measure of total community interaction (Stutz, 1974a). He determined community boundaries for the latter study by constructing a 75 × 75 origin-destination matrix of nonwork trip flows.[a] Strong and weak communities were identified (Table 38; Figure 44). The shaded tracts are parts of communities and have stronger localized interaction than those not shaded. The order in which the communities have clustered in the analysis, the number of tracts that have entered, and the average magnitude of each tract's association for a community denote the level of community strength. High values for a group of tracts in a community suggest a cohesive group, whereas low values suggest dissimilarity of tracts on the basis of activity patterns of the residents. The latter situation may be caused by a variety of reasons, such as service-node dispersion or a lack of community interest which is reflected in interaction.

Was there close agreement between the interactance communities and the City of San Diego Planning Department's named communities? In an effort to answer this question, maps of interactance and named communities were superimposed (Figure 44). Interactance communities are shaded areas and named communities are outlined. The areas which are not included in the two simultaneous definitions of community have been circled. In the northern portion of San Diego there is apparently a relatively high degree of congruence between the boundaries of interactance communities and named communities.

Serra Mesa and Navajo appear as weak communities, at least compared to La Jolla. Field interviewing in tracts 6 and 11 tend to confirm these as strong community areas with a strong sense of place. Field interviewing in tracts 42 and 46 tend to suggest that these areas, rather than being strong, independent areas, are less strong in terms of interaction and community consciousness. An examination of the responses for tract 31, a tract not entering an interactance community, suggests its weakness. Many residents have experienced a sense of placelessness.

[a] The methodology used here was based on clustering trip flows among census tracts. It is similar to that cited in Chapter Two.

TABLE 37. COMPARATIVE RANKING OF CRITERIA IN FREEWAY LOCATION BY COMMUNITY GROUPS

	Community Groups Ranking Criteria				
Criteria	Mayors Council	City Managers	City Engineers	City Planners	Citizens
Avoid Neighborhoods	2	1	2	1	1
Avoid Business Dislocation	1	2	1	4	2
Quickest Routes	3	4	4	5	4
Least Construction Cost	4	6	3	8	3
Avoid Parks	5	5	6	3	5
Fit Surroundings	6	5	5	2	7
Through Urban Renewal Area	7	7	7	7	6
Scenic View for Driver	8	8	8	6	8

Source: Bishop *et al.*, 1970.

TABLE 38. INTERACTANCE COMMUNITIES BASED ON CLUSTERS OF ALL NONWORK TRIPS BY CENSUS TRACTS

Census Tract	Community I La Jolla	Community II Pacific Mission Beach	Community III Clairemont	Community IV Morena	Community V Linda Vista	Community VI Clairemont East	Community VII Serra Mesa	Community VIII Navajo
1:	0.92	9: 0.44	20: 0.80	26: 0.79	35: 0.93	32: 0.74	39: 0.68	44: 0.41
2:	0.89	10: 0.47	21: 0.81	27: 0.78	36: 0.96	33: 0.94	40: 0.69	45: 0.75
3:	0.89	11: 091	22: 0.43	28: 0.77	47: 0.89	34: 0.85	41: 0.66	46: 0.65
4:	0.46	12: 0.91	23: 0.51	29: 0.58				
5:	0.82	13: 0.67	24: 0.85					
6:	0.88	14: 0.75	25: 0.52					
7:	0.40							

Source: Stutz, 1974a: 408.

The tract labeled 7, the Sessions Park Area, has the lowest loading on the La Jolla factor (note in Table 41 the loading for variable 7). It is the most remote part of the La Jolla community. It is also functionally distant because of the elevation of tract 5 located in mountainous terrain above it, and its shopping orientation toward Pacific Beach to the southwest. The dissimilarities among individuals are also important. This tract ranks well below the adjacent tracts in terms of urbanization. Social area analysts measure urbanization according to the percent of females in the labor force, the fertility ratio, and the percent of single family dwellings. Social

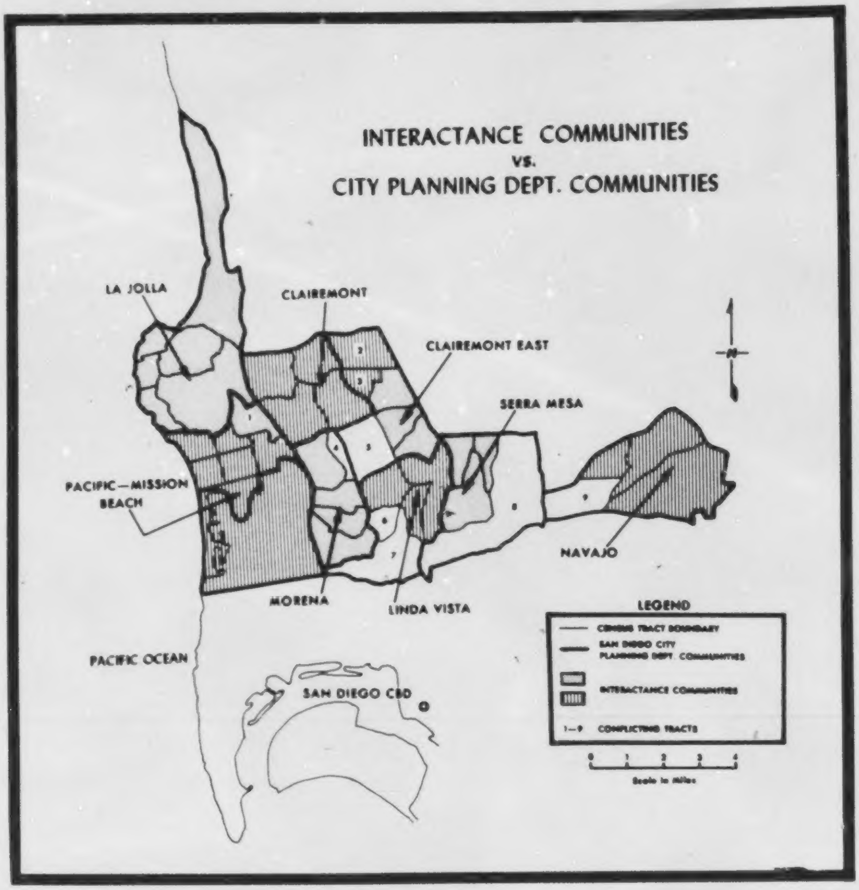

INTERACTANCE COMMUNITIES
VS.
CITY PLANNING DEPT. COMMUNITIES
LA JOLLA
CLAIREMONT
CLAIREMONT EAST
SERRA MESA
PACIFIC—MISSION BEACH
NAVAJO
MORENA
LINDA VISTA
PACIFIC OCEAN
SAN DIEGO CBD
N
LEGEND
CENSUS TRACT BOUNDARY
SAN DIEGO CITY PLANNING DEPT. COMMUNITIES
INTERACTANCE COMMUNITIES
1—9 CONFLICTING TRACTS
0 1 2 3 4
Scale in Miles

Figure 44. Circled tracts indicate a disagreement between the interactance community definition and the city planning department definition. In general there is a close agreement between the two methods. In every case, circled tracts are weak communities on the basis of interaction (Stutz, 1974a: 409).

area analysis helps explain the differing interaction of these areas near to one another as a product of social characteristics. Substantial differences also exist in other conflicting tracts. Although tracts 22 and 25 differ from adjacent tracts in urbanization, the tracts labeled 37, 38, and 42 have concentrations of nonwhite populations as shown by the segregation dimension of social area analysis. These person differences may help explain the conflicting nature of these tracts and have reduced the degree of interaction among the area residents.[9]

Notwithstanding the macroscale of the multitract interactance communities, whole communities as well as units within them can be targeted as strong or weak. Strong internal interaction and community consciousness is a necessary element for the prevention of environmental deterioration. Strong community consciousness and interaction are not likely to develop or sustain themselves in subareas with diffused social interaction and service-node dispersion.

If planners conduct surveys, build highways, and administer funds on poorly defined communities, they may make costly mistakes that will lead to further community decline.

Social Cost Models of Route Location

Most freeway locations have been selected by using economic procedures exclusively. The economic and engineering procedures used for locating freeways have failed to include social and environmental costs as part of their overall evaluation framework. Route alignments are evaluated in terms of their efficiency of return on invested capital through benefit-cost studies, or on their effectiveness in attaining given goals through net present value methods. The present benefit-cost methodology as employed for route location has two major elements: 1) the savings in travel time, operating expenses, and safety given by the new highway to the user, and 2) the sum of engineering, land and building costs, construction, operation, and maintenance costs. Other benefits accrue from the upgrading of land uses aroung the highway, frequently changing agricultural to industrial land or commercial to residential uses. These increases are great and, in certain regions, they are multiples of the cost of the highway itself. (Unfortunately it is private land developers who reap the profits of such impact while the citizenry must pay the enormous costs of the project.) But highways constitute a health hazard and a danger; they produce noise; they can destroy the cohesion of communities, institutions, residential environments; and they can harm scenic, historic, and recreational values of the land. Highway commissions have been criticized severely for their failure to include social and environmental costs in route location procedures.

Route selection should incorporate the best possible alternative derived from consideration of ecological, engineering, and economic factors. The basic component of all selection methods is the collection and analysis of data on the natural and cultural features of the affected area. Data should be gathered on vegetation types, wildlife habitats, ranges of rare or endangered species, land use and zoning sites of historical or archaeological importance, recreational areas, and geological and hydrological features, as well as engineering criteria for the area. It is important to quantify as much as possible the information provided by ecologists, cultural resource experts, hydrologists, and engineers. Frequently these data are then placed on impact maps for visual representation. These maps are helpful in presenting reports to regulatory bodies, citizen groups, and highway commissions (Abbot and Birmingham, 1973).

Data which are eventually placed on an impact map may be assembled by either one of two methods. The first employs the computer to analyze the data and map out a route with minimum overall impact (Denbrock, 1975; Hartsook, 1973; Hulett and Poppens, 1973). Several features of this approach are potentially undesirable, however. In assigning importance-values to each type of data, one must make a subjective assessment in advance of working on a particular route. Therefore, during the selection project itself, there is a lesser chance to adapt these priorities to the specific situation. Furthermore, computers produce shaded maps that are not easily correlated with base maps needed for permitting adequate interpretation, such as a U.S. Geological Survey topographic map or a county highway map. The second method is manual and employs overlay maps that depict the actual physical characteristics of the area (McHarg, 1969; Schaal, 1972). The base map shows universal landmarks, county outlines, major highways, and proposed rights-of-way. Next, the data collected are transcribed onto transparent sheets which are placed on the base maps to form an overlay. Data may be shown by a single variable or may be in any combination that assists in determining the path of least resistance to the visual, physical, social-cultural, economic, ecological, political, and hydrological obstacles present. Actual route selection involves several steps in which the number of alternative corridors progressively decreases until there is one best choice route and several second choices. In spite of the extra clarity of manual maps, they cannot be scaled without a preprocessing computer program. It is virtually impossible for a cartographer to produce a map properly scaled, but a computer can produce one with a line shading, or better yet, line plotting. The latter technique adds resolution that the shaded map does not have. The impact map approach is usually attributed to

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[9] The tracts in conflict when comparing interactance communities and named communities are, almost without exception, weak communities. None of these tracts load on any community more than 0.50. Most of these conflicting tracts do not enter any factor pattern. The tract labeled 7 in Figure 44 is the lowest loading tract on the La Jolla factor. The tracts labeled 22 and 25 are within the bottom one-half of all tracts loading on the Clairemont factor. Tracts labeled 8, 30, 31, 37, 38, 42, and 43 do not enter a factor pattern. This suggests that the conflicting tracts are weak in terms of localized community interaction. Tracts labeled 7, 22, and 25 are not distinctive enough in terms of community ties to be placed within their proper interactance communities by the city's intuitive method. The result is that they have been placed within the wrong communities. The tracts 30, 31, 37, 38, 42, and 43 are not strong enough to enter an interactance community but have been arbitrarily placed within communities by the planning department, probably owing to the criterion that all tracts must be part of some community.

Ian McHarg, who used the manual method of map production.

McHarg's Model of Least Social Cost

In his well-known book, *Design with Nature* (1969), McHarg documents efforts by his planning firm to find a socially acceptable route for the Richmond Parkway that had been planned to transect an important greenbelt in New York City. He employed two groups of factors—physical and social. The first group of factors included some of the orthodox variables usually employed by engineers—bedrock, slope, soil conditions, drainage and erosion, and flooding danger. The second category of variables concerned natural and social processes and included areas of scenic value, historic value, water value, forest value, wildlife habitats, recreational value, residential importance, general land values, and institutional importance. Each study cell was subjectively scaled by the research team into one of three ranked categories of low, moderate, or high depending on their assessment of the importance of the variable in it (Table 39). Each variable was then mapped manually and photographed with its three grades of value as a transparent overlay. The transparencies of the first group of physical variables were superimposed upon one another to show the composite of physical factors that influenced route location. Next, the transparencies of each social variable were overlaid upon one another to produce a social composite map. The two composite maps were then overlaid. McHarg states that "The darkest tone then represents the sum of social values and physiographic obstruction to a highway corridor; the lightest tone reveals the areas of least social value representing the least direct cost for highway construction. The highway should be located in that corridor of least social value and cost, connecting points of origin and destination. Moreover, it should provide new values—not only of convenience, but also of scenic experience—as a product of public investment" (McHarg, 1969: 35).

TABLE 39. McHARG'S TEN SOCIAL COST VARIABLES

LAND VALUES	
ZONE 1	$3.50 a square foot and over.
ZONE 2	$2.50–$3.50 a square foot.
ZONE 3	Less than $2.50 a square foot.
TIDAL INUNDATION	
ZONE 1	Inundation during 1962 hurricane.
ZONE 2	Area of hurricane surge.
ZONE 3	Areas above flood line.
HISTORIC VALUES	
ZONE 1	Richmondtown Historic Area.
ZONE 2	Historic landmarks.
ZONE 3	Absence of historic sites.
SCENIC VALUES	
ZONE 1	Scenic elements.
ZONE 2	Open areas of high scenic value.
ZONE 3	Urbanized areas with low scenic value.
RECREATION VALUES	
ZONE 1	Public open space and institutions.
ZONE 2	Non-urbanized areas with high potential.
ZONE 3	Area with low recreation potential.
WATER VALUES	
ZONE 1	Lakes, ponds, streams and marshes.
ZONE 2	Major aquifer and watersheds of important streams.
ZONE 3	Secondary aquifers and urbanized streams.
FOREST VALUES	
ZONE 1	Forests and marshes of high quality.
ZONE 2	All other existing forests and marshes.
ZONE 3	Unforested lands.
WILDLIFE VALUES	
ZONE 1	Best quality habitats.
ZONE 2	Second quality habitats.
ZONE 3	Poor habitat areas.
RESIDENTIAL VALUES	
ZONE 1	Market value over $50,000.
ZONE 2	Market value $25,000–$50,000.
ZONE 3	Market value less than $25,000.
INSTITUTIONAL VALUES	
ZONE 1	Highest value
ZONE 2	Intermediate value.
ZONE 3	Least value.

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In the case of the Richmond Parkway route alignment, the Tri-State Transportation Commission reversed its decision to transect the greenbelt in New York City and accepted the least social cost alignment developed by McHarg. Although this method is not a precise process of route alignment, it has the merit of incorporating variables currently employed and adding new social and environmental ones to the decision making process. Its main disadvantages are, obviously, the lack of any precise scaling and weighting of variables among one another and the difficulty of incorporating monetary values. But given these limitations, the least social cost method, backed up by the person of Ian McHarg, his book *Design with Nature*, and the controversial Richmond Parkway Study, has had the effect of sensitizing rights-of-way designers to the necessity of social and environmental awareness. McHarg has made a profound impact on the location of highway routes and of energy and communication transmission corridors.

A Scaled Least Social Cost Model

Thomas Hartsook (1973) applied a modified McHarg approach to social and physical features gathered from air photographs and county resource maps, and by direct observation by a group of students. The rectangular study area covered 74 square miles and was located in the southwestern portion of San Diego County just beyond the urban fringe. State Highway 52, which had been proposed for this area by the California Department of Transportation, was to be primarily a commuter route with little or no local access. The selection of

Route 52 for consideration in this study was prompted by the controversy over the proposed alignment by the Department of Transportation. Several alternate routings had been proposed and some of these substantially altered the natural landscape and traversed a regional park, a state historical site, and a wildlife preserve. Hartsook used study data identical to McHarg's social and environmental variables, as well as traditional engineering variables. These data were coded for the 2,052 data cells in the study area and the results obtained were found to be accurate within ten percent of the actual conditions. Hartsook attempted to reduce the redundancy of covarying and overlapping variables with a simple rating matrix. If variable 1 had any positive effect on the occurrence of variable 2, both variables were reduced in weight by five percent, since there were twenty variables used. In this way, if a variable was explained fully by all other variables it would have zero weight. Hartsook produced computer generated composite line printer maps for the different physical and social variable classes (Figure 45). Although his system was arbitrary to a degree, it was a step in the direction of weighting variables.

Recently there has been interest in incorporating social variables into the process of electrical transmission corridor routing (Hulett and Poppens, 1973; Schaal, 1972; Voytko, 1972; Willard, 1973). An approach similar to McHarg's was used for transmission corridor route location by Denbrock (1975) of Commonwealth Associates. He evaluated likely environmental factors affecting electric transmission line locations on the basis of nine numerically scaled variables (Table 40). He assigned each variable a scale value, ranging from 1 to 10. Zero represented no impact and 10 represented a great impact. Whenever a line could not be located because of FAA regulations, microwave, or radio tower positions, the data cell was assigned the value of 99. Computer outputs consisting of plotter shadings were produced to correspond visually with the degree of impact associated with each variable (Figure 45). With the origin and destination of the line known, the impact maps identified the route of least environmental and social resistance. A

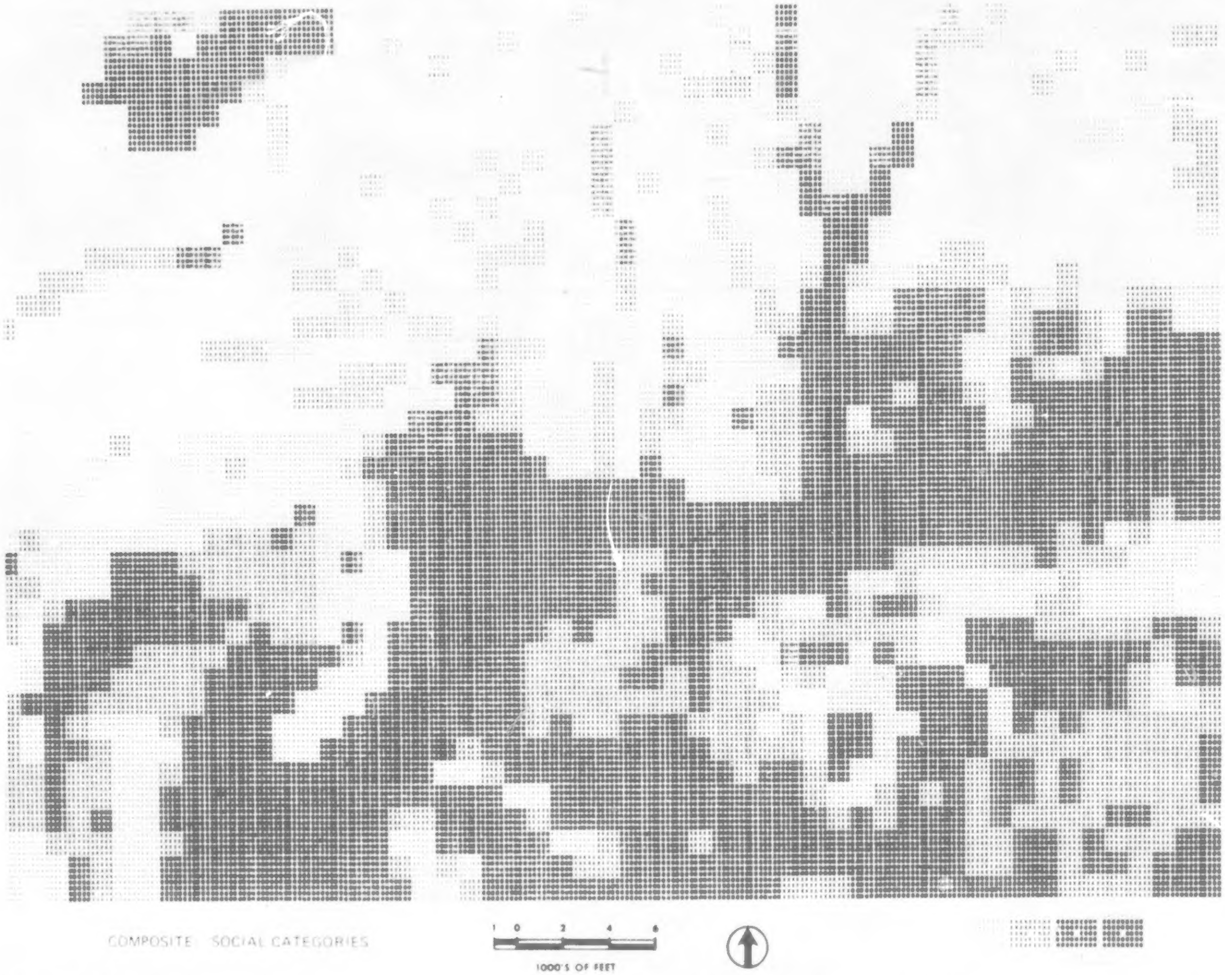

Figure 45. Computer-generated map combining McHarg's ten social variables for a portion of southwest San Diego County for which a new freeway has been proposed. Each data cell is one-fifth square mile, with darker shades indicating higher social costs (Hartsook, 1973).

number of alternative routes could be sighted and compared by adding respective cell values over which each alternative line runs. The alternative segments in combination represent the total alternatives for final comparison. "The arithmetic sum of impact values for each alternative route is tabulated and compared for optimally compatible corridors, one-quarter mile in width. Final corridor selection is made after field inspections, high resolution aerial photographs, economic cost of construction, and rights-of-way acquisition studies" (Denbrock, 1975). At least one other attempt to improve the corridor selection process by reducing the overlap of social variables has been forwarded. For a treatment of this mathematical approach, see Technical Note 3.

Conclusions and Policy Recommendations

Caution should be taken to skirt existing communities with new highway rights-of-way. Precise studies should involve those people to be affected by the location of new expressways. Noise, fumes, and visual intrusions can be reduced by buffers and walls, but a continuous sound-proofing would lead to miles of visual blight. Buffers must be applied with care, and blended to the landscape (Figure 46). The best type of buffer is through land use planning. Zoning can be a strong local control of the type of new development, but has little control over existing land uses. Zoning can exclude typically incompatable uses, such as residences, from noise and pollution by allowing only industrial or agricultural uses. This is a simple and effective technique. However, such zoning may conflict with other plans for community growth, and it may render the land worthless if no demand exists for industrial or agricultural land. Zoning can also regulate the specific details of development design or construction, such as limits on building height or requirements for buffer strips, noise barriers, and sound insulation construction. This is usually effective, but often the application of these requirements extends to buildings that do not need the special construction techniques to be compatible with the expressway. Finally, zoning can permit special development concepts such as cluster and planned unit development. These forms of incentive zoning make possible developments with significant advantages over the conventional subdivision.

The bus is the most important element of public transportation because it has the lowest start-up costs and is the most common public mode. People will choose the bus over their cars only if the frequency, characteristics, and level of service is substantially improved. Bus riding can be uncomfortable, slow-moving, noisy, and subject to a fair amount of waiting. The buses need streamlining and bus stops need seating, shade, parking, newstands, and lighting for nighttime use. Minibuses should operate in low density areas on flexible routes. Some buses could have open top decks for use in the summer months. This is a popular system in Yosemite National Park and this deck is always the quickest to fill.

Rapid Transit

Many cities are considering the use of rapid transit trains to serve their cities. They can offer fast comfortable service and free the rider to read or relax in ways that are impossible in the automobile. The system is safe and usable for children. The major disadvantage is the great expense. The social image of the rapid rail system should be attractive to a large group of the populus. The selection of such a transit system will involve many social and environmental impact considerations. The frequency of service and the placement of stations will affect the speed of travel and the number of local communities that will be disrupted. The precise location of the rights-of-way and stations must not be disruptive. The BART experience in San Francisco indicated that if a system does not respect the local fabric of the land, and if engineering considerations are dominant during the design stages, the system may not be popular with its intended constituency. Corridor surveys similar to those of highway location must identify sensitive areas, community territories, and pedestrian dependent areas. Stations should be designed as part of existing communities and have not only good access, seating, and lighting, but also should be an important organization point where individuals can meet. Some stations such as those of the BART system and those of the underground, rubber-tired Metro system in Montreal are truly artistic achievements. The stations could have shops and pedestrian malls, bulletin boards, and pictures and maps of the local area so that they become a community asset rather than a detraction (Figure 47).

Financing Rapid Transit

Inevitably, the question of rapid transit development is an act of restructuring the city into high density corridors. Enormous development is taking place in San Francisco around BART stations, for example, but the

BUFFERING TRANSIT NOISE

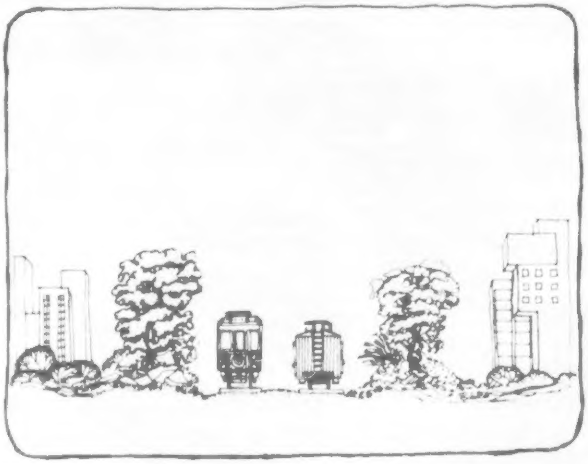

Figure 46. Noise buffer along light rail line.

TABLE 40. ENVIRONMENTAL CRITERIA FOR POWER LINE CORRIDORS

1. Vegetation		**6. Land Use Restraints**		**8. Land Ownership Concentration**	
Percent, 100% = 10,90% = 9, 80% = 8, etc.		Industrial Areas	− 2	1 owner per 40 acres	1
		Cemeteries	− 3	2 owners per 40 acres	2
2. Topography		Extractive	− 3	3 owners per 40 acres	3
Elevation change 0–50 feet	− 0	Landing Strips	− 6	4 owners per 40 acres	4
Elevation Change 50–75 feet	− 5	Natural Historic Sites	− 8	5 owners per 40 acres	5
Elevation Change 75 feet plus	− 8	Highway Interchanges	− 8	6 owners per 40 acres	6
3. Water		Institutions	− 8	7 owners per 40 acres	7
River, Creek, Pond	− 2	Commercial Centers	− 8	8 owners per 40 acres	8
Wetland, Lake	− 8	Parks and Recreation	−10	9 owners per 40 acres	9
4. Transportation		Wildlife Preserves	−10	10 owners per 40 acres	10
Unimproved	− 2	Radio, Microwave Towers	−99	Small tracts	99
Secondary	− 4	Airports	−99	**9. Soils—(Agriculture capability high to low, Class I to IV)**	
Primary	− 6	**7. Future Land Use**			
State	− 8	Agricultural and Open Space	− 0	Class I	10
Interstate	−10	Industrial	− 2	Class II	8
5. Population Density		Proposed Highway Corridor	− 4	Class III	6
Vacant (0)	− 0	Commercial	− 6	Class IV	4
Low Density (1-5)	− 2	Proposed Highway Interchanges	− 8	Class V	0
Medium Density (6–12)	− 4	Institutions	− 8		
High Density (13-25)	− 8	Residential	−10		
Very High, Urban (25+)	−10	Parks and Recreation	−10		

Source: After Denbrock, 1975.

system itself has always been in a financial crisis. Knowing this transportation impact principle, businessmen became wealthy in the early 1900's not so much through revenues generated from their streetcars, but mainly by selling and developing real estate along the tracks.

Since then mass transit has become hopelessly unprofitable. It has since been left on the government's doorstep. Transportation related development profits have remained almost entirely in private hands, however. In order for the fixed rail system to become something other than a great financial burden to the citizenry, the transit district should be able to share in the increased land value created by its public transit investment. The question is, how can this be accomplished?

One method would be purchase tracts of land along the proposed fixed guideway route. The transit district could then sell or lease this land to private interests for high density commercial and residential development. This process is similar to the selling and leasing of land in city-owned industrial parks. By establishing a transit district, the region could then both plan and control land uses for each area affected, and the capital appreciation induced by the transit system would also help pay for it.

Another method would use special tax dollars generated from the expected new development along the route. There are instances in which public improvements are financed through such an increased tax. A recent California law allows urban redevelopment to be financed through the tax increment approach. Any taxes collected from increases in property valuations within a redevelopment project can then be earmarked to pay for the public costs of the project. The Horton Plaza Rede-

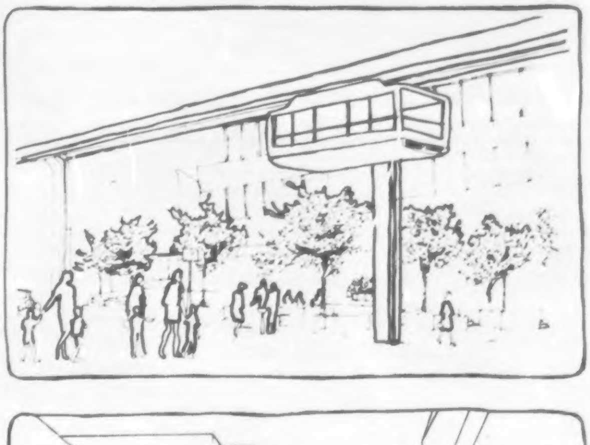

Figure 47. Transit stations of the future should be well-landscaped and can blend into the community (top) or downtown (bottom) setting. They can be points of social interaction for adults and children alike, as well as information areas.

velopment Project in downtown San Diego, as well as the Bunker Hill Project in Los Angeles and the Yerba Buena Project in San Francisco, are using this method of financing.

Applied to transit, tax increment financing would seem to be more equitable, since it may be argued that transit development has a more direct effect on property assessments than does urban renewal, and the benefits of transit accrue to a much broader spectrum of the populus than does such commercial urban renewal as Horton Plaza, which chiefly benefits downtown businessmen.

Tax increment financing should be extended to transit development through new state legislation, which would allow bonds to be sold as a result of additional revenue generated by increased property tax assessments around transit stations. Normal profits would accrue to land owners and businessmen from the transit system, but their added taxes would help pay for the mass transit. This would also allow cities to be free from dependence on unpredictable Federal financing.

TECHNICAL NOTE 3: A SOCIAL COST ROUTE LOCATION REFRACTION MODEL

The social cost route location refraction model used information gathered by Hartsook in the San Diego Highway 52 study (Chapter Four), but covariation was reduced by means of factor analysis. Stutz (1974b) states that "Admittedly, these variables are but crude estimates of the actual social costs that should influence highway location. But until precise values for the intangible elements of the environment can be assigned, approximations of surrogates such as these will suffice." An 8 × 2,052 data matrix was constructed in which the nine social cost elements were considered as variables, and the 2,052 cells of the study area were considered as observations. The resulting rotated factor matrix for factors with eigenvalues greater than unity is shown in Table 41. The variables loading highly on Factor I (recreation, institutional, and historical value) are measuring a public, open space, recreation dimension. This factor was labeled recreational. Factor II measures residential value or potential and has variables of urbanization, land value, and residential quality loading highly on it. It was labeled residential. Factor III was labeled biotic, and the variables of vegetation and wildlife, both of which are affected by a third variable, availability of water, load highly on this factor. Approximately sixty percent of the total variation in the nine data categories was explained by three dimensions. The cell weightings on each factor are shown by the factor scores and these were mapped for each factor. Composite factor scores given by the sum of each observation scaled in proportion to the explained variation of each factor were then computer mapped (Figure 48).

Next a modified version of the flow refraction model was developed. Two types of costs for transportation route locations are usually distinguished: those attributable to construction of the route and those dependent upon movement on the route. The former include capital costs of land acquisition, construction costs, and continuing costs of facility operation and maintenance. The latter include travel time, discomfort and inconvenience costs, and continuing costs for user vehicles. These two costs were assumed to be linear functions of the length of the route and the volume of flow. The study area was assumed to be heterogeneous with respect to those factors that determine social costs. Social costs were assigned to each small area (1/5 mile square) of the study region. The resulting social cost density surface could have been summarized by fitting to the cost values a surface using a high degree polynomial. This may involve extensive iterative approximations if the powers are higher than the third degree. For simplified applications, it was possible to divide the study area into subregions having approximately equal social costs per unit length. This simplification fit the empirical study area well because of the semiarid climate and concentrations of high social cost areas in wooded stream canyons. This division was also based on the assumption that flow and construction costs are everywhere constant. Even though this latter assumption may not be always valid, it was used to help clarify the role of social costs for route locations. Stutz then let F_1 and F_2 be the origin and terminus points of the proposed route. He let s be the value per mile of social costs, t the cost per unit per mile of traffic, f the volume of flow or traffic, and c the cost per mile of route construction. For a route with length d, the total costs K were stated as

$$K = sd + tfd = cd = (s + tf + c)\,d.$$

But social costs varied over the study area. If the plane is divided into a number of social cost regions G for which total costs K are taken as constant, then

$$K = \sum_{j=1}^{n} k_j d_j,$$

where j runs over all costs regions G. The minimum cost route was composed of straight lines within each cost region which angle away from areas of high social cost, with the angle of deviation from the straight line path being proportional to the size of the increased cost. Route crossings were at border points, H_j, between cost regions G. Let H_j have coordinates (a_j, b_j). The total cost K for a route with border points $H_1, H_2, H_3 \ldots H_n$, is stated as

TABLE 41. ROTATED ENVIRONMENTAL VARIABLES FOR SAN DIEGO HIGHWAY LOCATION*

Variable	FACTOR I Recreational	FACTOR II Residential	FACTOR III Biotic
Recreation	0.863	0.059	0.152
Institutional	0.829	−0.025	0.125
Vegetation	0.189	0.253	0.856
Urbanization	0.292	0.835	−0.051
Historical	0.518	0.019	−0.009
Land Value	−0.022	0.591	−0.111
Residential Quality	0.134	0.808	−0.003
Scenic Value	0.364	0.160	0.317
Wildlife Habitat	0.204	0.215	0.856
Percent Variance	22.909	20.441	17.999
Cum. Percent Variance	22.909	43.350	61.347

* Loadings 0.500 are underlined.
Source: Stutz, 1974b: 137.

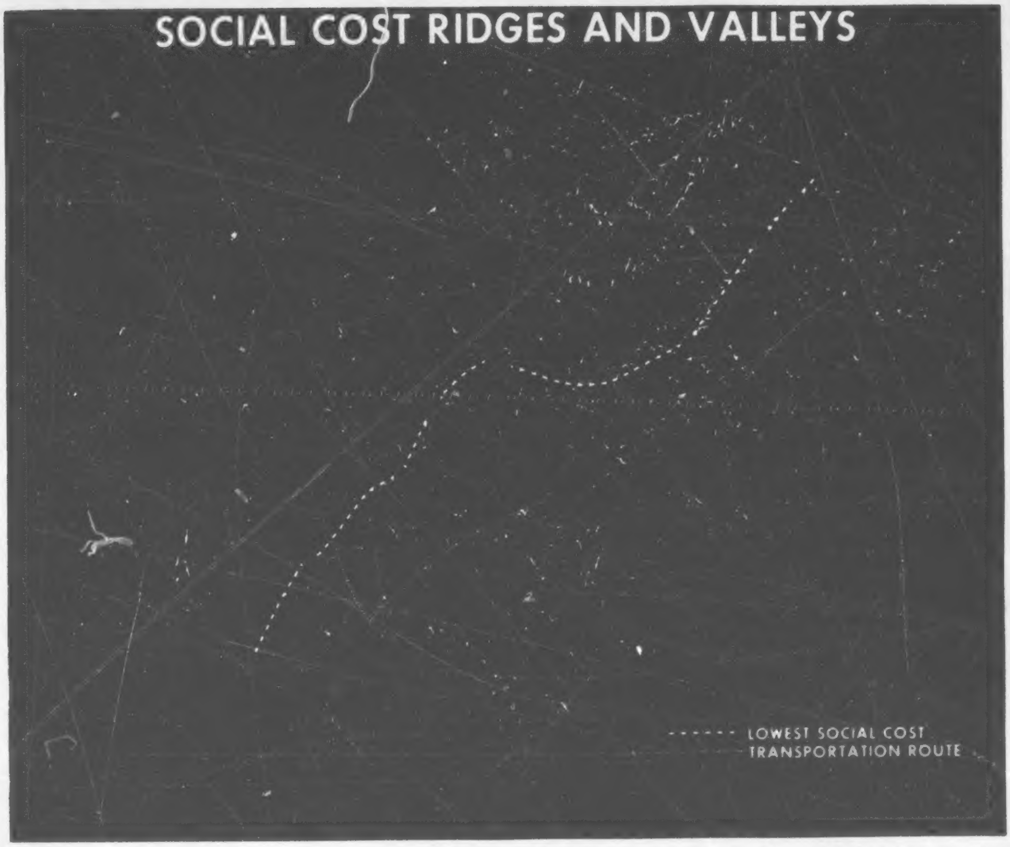
SOCIAL COST RIDGES AND VALLEYS
------ LOWEST SOCIAL COST TRANSPORTATION ROUTE

Figure 48. Computer-scaled and generated social cost surface for an area of San Diego for which a new freeway is planned. The ridges are composite factor scores of nine environmental variables (three factors). The factor scores were given by the sum of each observation scaled in proportion to the explained variation of each factor. The lowest social cost path through the ridges and valleys was determined by adapting the flow refraction model. This study has been presented to the California Department of Transportation. Currently this route has been delayed indefinitely, because of protest by environmentalists and lack of funds.

$$K = \sum_{j=0}^{n} k_j \, [(a_j - a_{j+1})^2 + (b_j - b_{j+1})^2]^{1/2}$$

If x_i and y_i are the acute angles at the border of any region formed by the route passing from cost region G_i, with costs k_i, to region G_{i+1}, with costs K_{i+1}, the minimum cost route location can be shown to consist of straight line segments which cross our regions G at border points where

$$\frac{\cos x_i}{\cos y_i} = \frac{k_{i+1}}{k_i}$$

A crossing point formulation for two general cost regions similar to equation 4 has been given by Lösch (1954), and a multiple general cost region formulation by Werner (1968). The placement of border points continues until the sequence of route segments connects points F_1 and F_2 (Stutz, 1974b). Identification of the components of social costs which are contained within k were outlined above. The resulting social cost flow refraction route (after smoothing) was then plotted on the computer through the social cost terrain (Figure 48).

The above methodology improves on previous approaches. However, it still does not handle monetary weighting of social variables. Information integration theory from mathematical psychology, which is based on human evaluation and preferences, could be the final link needed to make the above route selection process an objective reality. This technique was used earlier (see Technical Note 2) for a behavioral model of beach selection. It was originally developed by Anderson (1962, 1974) and was brought to the attention of geographers by Louviere (1973a, 1973b). Respondents could trade-off social and environmental attributes resulting in a scaled set of variables according to their perceived importance. One of the variables to which each other attribute would be compared could be a dollar value. For example, people have an idea of what they are willing to spend on a residential site given a certain set of attributes such as a "view lot." In this manner, the value of social and environmental attributes to society could be approximated.

V. CONCLUSION

The study of transportation has had a strong economic and engineering orientation. Most of the major contributions and research in the field have been economic in approach. Only a small amount of literature exists on social aspects of transportation and this Resource Paper has attempted to review a portion of it relevant to geography. The social models of transportation are the ones most sorely needed in the present era, which emphasizes environmental quality, human behavior, and the rights of minorities; and it is now necessary to incorporate these social dimensions into traditional transportation plans.

Planners are just now beginning to understand the dynamics of social interaction in community cohesion and the role this cohesion plays in urban functioning. Some of the problems of urban living center on the establishment of a meaningful set of social ties. This problem is compounded by the migratory nature of urban households and long work trips, each of which tends to create a trail of acquaintances geographically dispersed across city space. Nevertheless, social ties over distance have been aided and maintained in part by using communications technology. Many other types of human interaction rely on electronic communications. But this substitute is not completely adequate to reestablish the intensity of traditional face-to-face social relationships.

Organizing Space

Planning for better cities should involve emphasizing the organization of spaces in which people will likely live. If transportation planning is to promote a better life in the future, people, not facilities, should be the first priority of the planning process. The disadvantaged are now beginning to receive the attention that they deserve in this process. Small pockets of disadvantaged groups still remain isolated, especially in rural areas. Paradoxically they have a good knowledge of both the people and the space surrounding them. Perhaps this is because they are aware of the limitations within which they operate. New design of mass transit facilities, not only the movement units themselves but their schedules and routes, are helping to relieve social costs and barriers that have restricted the mobility of the disadvantaged.

To estimate the precise social costs associated with the impacts of a transportation route is another matter. Economic costs and benefits can be measured, albeit the user time benefit of a new facility is difficult to identify. But social costs and benefits can hardly be measured at all and have either been guessed at or omitted altogether in traditional planning. Although the law requires monetary compensation for family relocation from the path of ensuing expressway construction, we cannot measure its precise social costs or benefits. Is it possible to place a value on a human life to justify the improvement of an existing state highway on which one death per week occurs because of a highway accident? It is difficult to answer such questions because of our imprecise methods of handling social costs and benefits. How does money spent on increased mobility reduce community strength, and what is the overall net result in light of an individual's social well-being?

Even if we were able to assess properly these social costs, and further, to equate these with economic and engineering costs, the situation is complicated by the fact that costs and benefits (or positive and negative impacts) affect people differently according to their location, point of view, income level, and mobility. All we can presently hope for is that planning groups discuss these social considerations in an open and unbiased manner and that the thinking derived from these discussions be embodied in final implementation. Present social costs and benefits of new systems must be weighed against the best estimates of future social costs and benefits.

Social Accountability

State and interstate highways in the United States are, for the most part, complete. Nearly every place can be reached by road. New highway construction on the urban fringe has contributed to urban growth, with the frequent result of new highways becoming congested soon after completion. Many of the thousands of miles of expressways, highways, and roads are relatively new and, as they become older, they are going to require more money to maintain and to expand. Houses and businesses must be removed every time new expressways are built in populated areas. In other areas, valuable farm and recreation land is taken out of production.

The United States is feeling the energy pinch. In the future, gasoline will be more expensive than it has ever been. It is likely that there will not be enough gasoline for people to drive as much as they would like. Exhaust control devices on cars have improved, but because the total number of cars has been increasing, the air is not getting much cleaner. Damage from smog is estimated to be as much as $6 billion a year in the State of California alone (about $300 per year for every man, woman, and child). Unless something is done to cut down on the number of miles driven, many cities will never meet the U.S. clean air standards

In the not too distant future, social costs of transportation may become painfully high for motorists and may result in life style changes. Inequities caused by the present distribution of transportation costs, not to mention expected future high energy costs, and the growing awareness of the damaging effects of noise, congestion, and air pollution are leading to various means of persuasion that would cause drivers to use public transportation. In the future, motorists may be charged for using their own cars and the resulting revenues would be used to pay the social costs of the automobile. According to this "social accountability" concept, motorists not only pay the full costs of construction and maintenance of highways and streets, but also the costs of congestion, energy use, air pollution, and other by-products of the automobile.

With a national social accountability policy, all needed transportation services would be available, provided users are willing to pay for the social costs of using them. We can look forward to sharply increased fuel taxes, tolls on some roads and other facilities, tax penalties on modes of transportation seen as socially undesirable, assistance to public modes of transportation, and surcharges on parking spaces not only in downtown but also on every other public land use. Motorists may have to pay for the required police, court, and other necessary services with user charges such as gasoline taxes. Therefore, property taxes that now pay for these services would be reduced. There would be a savings in food and medical costs because the air would be cleaner. Urban areas would be quieter. The emphasis would be on carrying more people on existing roads than on moving more vehicles. Buses and car pools would be given higher priority on streets and highways than single occupant vehicles.

State and Federal subsidies would be made available to public transit operators. Public transit riders would continue to pay only a fraction of the cost of the service they use. However, transit fares would increase over time to cover a larger share of the cost as governments impose more equitable auto user charges. Transit services would not be limited to bus and rail services by public agencies; individuals and companies would be encouraged to furnish new and innovative services. Jitneys, taxis, and other paratransit options would increase individual choices for travel. Paratransit would also provide job opportunities for the unemployed. Finally, the poor and handicapped would be assisted by the government by direct financial aid for necessary transportation services.

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